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ELECTROMAGNETIC INTERFERENCE QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECKOUT BRIDGE SET

30 December 1965

Prepared by

Electronics Group

Approved by

D.K. Bailey

D.K. Bailey, Director
Engineering Development Laboratory

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

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TECHNICAL REPORT INDEX/ABSTRACT

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ELECTROMAGNETIC INTERFERENCE QUALIFICATION TEST OF APOLLO C14-354, PYROTECHNIC INITIATOR CHECKOUT BRIDGE SET

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ABSTRACT

AN ELECTROMAGNETIC INTERFERENCE (EMI) TEST WAS PERFORMED ON THE C14-354 PYROTECHNIC INITIATOR BRIDGE SET, MODEL PTS 6566, PART NO. G16-821050, SERIAL NUMBER 01-001, IN COMPLIANCE WITH THE REQUIREMENTS OF EMI PROCESS SPECIFICATION MA 0203-3544 AND MILITARY SPECIFICATION MIL-I-26600 AS AMENDED BY MSC-ASPO-EMI-10A.

THE EMI TEST CONSISTED OF MEASUREMENTS OF THE SELF-GENERATED EMI, CONDUCTED ON THE OUTPUT LEADS TO THE SQUIBS AND RADIATED FROM THE ENTIRE SYSTEM, AND SUSCEPTIBILITY MEASUREMENTS TO DETERMINE IF THE TEST SPECIMEN WOULD BE AFFECTED BY EXTERNAL RF FIELDS.

THE RESULTS OF THE EMI TEST INDICATED THAT THE TEST SPECIMEN GENERATED INTERFERENCE IN EXCESS OF THE PRESCRIBED RADIATED AND CONDUCTED LIMITS OF MIL-I-26600/MSC-ASPO-EMI-10A AND WAS SUSCEPTIBLE TO AN RF ENVIRONMENT OVER THE FREQUENCY RANGE OF 4.3 TO 300 MEGACYCLES.

TO MEET THE REQUIREMENTS OF THE GOVERNING SPECIFICATION, IT IS RECOMMENDED THAT ARC SUPPRESSORS BE INSTALLED ACROSS ALL RELAY CONTACTS, THE SHIELDING OF THE BRIDGE SET INPUT AND OUTPUT CABLES BE IMPROVED, AND THE DUMMY SQUIBS BE MODIFIED SO THAT THEY ARE COMPLETELY SHIELDED.

FOREWORD

This report has been prepared by the S&ID Engineering Development Laboratory, electronics systems test group, for the Apollo design GSE group under ATR 481041. This document is submitted to Department 692-601 to provide a profile of the electromagnetic interference measurements made on the C14-354 pyrotechnic initiator bridge set, Model PTS 6566, part G16-821050, serial number 01-001, in accordance with the requirements of Military Specification MIL-I-26600 (USAF) as amended by MSC-EMI-10A.

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INTRODUCTION

The electromagnetic interference test was performed on the C14-354 pyrotechnic initiator checkout bridge set, Model PTS 6566 part G16-821050, serial number 01-001, to determine its compliance to the conducted, radiated, and RF susceptibility requirements of MIL-I-26600 as amended by MSC-ASPO-EMI-10A.

Measurements of the conducted interference on the bridge set output leads to the pyrotechnic devices indicated that the pulse interference generated by the relays exceeded the limits of MIL-I-26600/MSC-ASPO-EMI-10A. The radiated pulse interference also exceeded the prescribed limits of the governing specification.

When the test specimen was exposed to the RF field prescribed by the specification, the indicator meters on the bridge set reacted in a manner that completely degraded its intended performance.

To reduce the excessive conducted interference, it is recommended that arc suppressors be installed across all relay contacts or RF filters incorporated in the output leads of the bridge set. The radiated interference level can be decreased by improving the shielding of the bridge set input and output cables, and the susceptibility problem can be relieved by the same shielding and by completely shielding the dummy squibs.

APPLICABLE DOCUMENTS

The following specifications are applicable to the tests performed on the bridge set:

Government Specifications

MIL-I-26600 2 June 1958	Interference Control Requirements, Aeronautical Equipment
Amendment MSC/ASPO-EMI-10A 17 October 1963	Amendment to MIL-I-26600
MIL-E-8881A 3 September 1959	Enclosure, Electromagnetic - Shielding, Demountable, Prefabricated, General Specification
MIL-B-5087A 29 January 1958	Bonding, Electrical (for Aircraft)
MIL-STD-831 28 August 1963	Test Reports, Preparation of

NAA (S&ID) Specifications

MA0201-3939 11 October 1965	Bridge Set, Pyrotechnic Initiator Checkout, Model C14-354, G16-821050, Functional Test, Procedure for
MA0203-3544 4 October 1965	Ground Support Equipment, Model C14-354, Electromagnetic Interference Test, Procedure for
QRL 2607 3 November 1965	Electromagnetic Interference Test Plan for Pyrotechnic Initiator Checkout Bridge Set Model C14-354, Part No. G16-82105011.
MA0613-002	Electrical Bonding Requirements for Apollo

TEST SUMMARY

PROCEDURE SUMMARY

The pyrotechnic initiator checkout bridge set system was composed of the remote control set (P/N G16-821055) the bridge set (P/N G16-821050), and six dummy squibs (P/N G16-821063). This system is referred to in this report as the test specimen and is considered Class I equipment, as prescribed in paragraph 3.5 of Reference (1). An electromagnetic interference (EMI) qualification test was conducted on the test specimen to determine its compliance to the requirements of Reference 1.

TEST INSTRUMENTATION

The radio interference-field intensity (RI-FI) meters used to accomplish the interference tests are those prescribed in Reference 1 and classified as category A measuring equipment. All RI-FI meters and support equipment were calibrated and operated in accordance with the manufacturers' recommendations and were approved by the National Aeronautics and Space Administration (NASA) Testing Laboratory.

TESTING ENVIRONMENT

The EMI test was performed in compliance with MIL-E-8881 in a shielded enclosure, 16 x 20 x 8 feet, located in the Central Instrumentation Facility (CIF) at Kennedy Space Center, Florida. The ambient interference level within the enclosure was below the background noise level of the RI-FI meter throughout the entire test frequency range.

ELECTRICAL BONDING AND GROUNDING

The remote control set and the bridge set were bonded to the copper ground plane in the shielded enclosure utilizing copper bonding straps with a minimum width-to-length ratio of 1:5. Each dummy squib was bolted to the ground plane at the ground stud.

TEST SPECIMEN LEADS

The cable that connected the remote control unit to the bridge set was designed to simulate the electrical length and shielding design of the cable installation to be used on the launch pad. The two output cables that connected the bridge set to the dummy squibs were 5 feet long and

complied with paragraph 4.2.5.2.1 of Reference 1. Each output cable consisted of three pairs of squib leads (shield twisted) with a shield zipper-tubing jacket that simulated the shielding of the operational cable.

The distance between cables and from each cable to the ground plane was approximately 2 inches. The cables were approximately 4 inches from the edge of the ground plane in compliance with paragraph 4.2.5 of Reference 1.

TEST INSTRUMENTATION OPERATION

The RI-FI meters and other test instrumentation were operated in accordance with the manufacturers' recommendations and within the provisions of Reference 1.

Because of the characteristics of the interference generated by the test specimen (transient pulses), the RI-FI meter was set to discrete test frequencies (three per tuning band minimum); and whenever the interference level approached the specification limit, a scan was made to locate the frequency at which maximum interference occurred.

The broadband interference measurements were performed at each test frequency with the appropriate RI-FI meter set in peak function position. As each switch on the remote control unit was actuated, the slide-back control reduced the audio level in the earphones until it was barely discernable. Over the test frequency range of 150 kc to 400 mc (while using the NF-105F interference meter), the meter impulse generator was actuated, and a substitution technique was employed to determine the amplitude of interference. When using the NM-10A interference meter over the frequency range of 15 kc to 150 kc, the meter was standardized as per the manufacturers' calibration manual, and the interference level was recorded directly off the meter.

When conducted interference measurements were performed, a current probe (clamped around each test lead) was used as the pickup device. For radiated measurement, the appropriate 41-inch rod and tuned dipole antennas were used as the pickup device.

TEST INSTRUMENTATION BONDING

During all conducted measurements, the appropriate RI-FI meter was bonded to the ground plane through the outer shield of the coaxial cable connected to the current probe. During radiated interference measurements utilizing the 41-inch rod antenna, the RI-FI meter was bonded to the copper ground plane through the coaxial cable shield,

antenna counterpoise, and ground strap. When radiated measurements were performed utilizing tuned dipole antennas, the RI-FI meter was grounded through the third conductor (ground) in the power plug.

ANTENNA ORIENTATION

During all EMI tests that required the 41-inch rod antenna, an antenna counterpoise was placed 6 inches below the level of the copper ground plane. The rod antenna was in a vertical position, 1 foot from the test specimen, and positioned for maximum pickup.

When the tuned dipole antennas were used, the dipole was positioned parallel to the horizontal axis of the test specimen, 1 foot above the level of the ground plane, and 1 foot from the test specimen. The center of the dipole was opposite the geometric center of the test specimen.

At test frequencies from 25 to 35 mc, the dipole antenna was adjusted to 35 mc. When using the directional microwave antennas, the antenna was placed 1 foot above the ground plane and 3 feet from the geometric center of the test specimen.

TEST SPECIMEN DESCRIPTION

The pyrotechnic initiator checkout bridge set MODEL C14-354 is composed of the following three separate components:

1. Pyrotechnic checkout bridge remote control, part G16-821055
2. Pyrotechnic initiator checkout bridge, part ME 403-0006-0001
3. Pyrotechnic checkout dummy squib(s), part G16-821063.

By means of a Wheatstone-bridge design, the test specimen measures the resistance of the six pyrotechnic devices installed in Spacecraft 009. The test specimen is powered by self-contained dry cell batteries installed in the remote control and the bridge set.

Six individual switches in the remote control unit are actuated to operate separate relays in the bridge set so that the resistance of each pyrotechnic device can be measured. The dummy squibs are used to calibrate the bridge set, and the pyrotechnic devices in the spacecraft are measured differentially.

FUNCTIONAL CHECKOUT

Prior to the EMI test the test specimen was functionally checked in accordance with paragraph 4.2.2 of Reference 3.

POWER REQUIREMENT

A 1.5-volt battery in the remote control unit energizes the relays in the bridge set. Incorporated in the bridge set are 1.35-volt batteries to power the bridge circuit and a 5.4-volt battery to power the bridge set amplifier.

TEST EQUIPMENT

The following NASA test equipment was used during the EMI test. The equipment was operated in accordance with the manufacturers' recommendations and displayed a NASA calibration sticker.

Nomenclature	Manufacturer	Serial Number
Radio interference - field intensity meter (basic unit) NF 105F	Empire Devices	A 128
Tuning head T/A NF 105F	Empire Devices	
Tuning head T/-1 NF 105F	Empire Devices	A 128
Tuning head T/-2 NF 105F	Empire Devices	A 128
Current probe, CP-105	Empire Devices	A 128
Current probe, 91550-1	Stoddart Aircraft Radio Co.	420
Radio interference - field intensity meter, NM 10A	Stoddart Aircraft Radio Co.	421-65
RI-FI power supply, 91923-2	Stoddart Aircraft Radio Co.	418-33
50-ohm impedance matching network, 90081-7	Stoddart Aircraft Radio Co.	550-58
41-inch rod antenna, 92197-3	Stoddart Aircraft Radio Co.	--
Antenna coupler, 92198-3	Stoddart Aircraft Radio Co.	417-33
Tuned dipole antenna, DM-105-T1	Empire Devices	--
Tuned dipole antenna, DM-105-T2	Empire Devices	--
Tuned dipole antenna, DM-105-T3	Empire Devices	--
Calibrated microwave test antenna, CA-L	Polarad Electronics Corp.	12-11
Calibrated microwave test antenna, CA-S	Polarad Electronics Corp.	13-11
Calibrated microwave test antenna, CA-M	Polarad Electronics Corp.	234
Calibrated microwave test antenna, CA-X	Polarad Electronics Corp.	370
Parabolic microwave reflector, CA-R_2	Polarad Electronics Corp.	1-22
Vacuum tube voltmeter, 412A	Hewlett-Packard	301-07890
Oscilloscope, 170A	Hewlett-Packard	NASA 36390
plug-in unit, 162B	Hewlett-Packard	NASA 36391

Nomenclature	Manufacturer	Serial Number
Oscilloscope camera	Hewlett-Packard	305-00347
Signal generator, 606A	Hewlett-Packard	301-04584
Signal generator, 608C	Hewlett-Packard	247-04929
Signal generator, 612A	Hewlett-Packard	NASA 35112
Signal generator, 8614	Hewlett-Packard	NASA 52546
Signal generator, 8616A	Hewlett-Packard	NASA 45966
Signal generator, 1107	Polarad Electronics Corp.	NASA 45612
Signal generator, 1108	Polarad Electronics Corp.	NASA 43485

TEST PROCEDURE

BROADBAND CONDUCTED ELECTROMAGNETIC INTERFERENCE MEASUREMENTS ON OUTPUT LINES - (15 KC to 25 MC)

The conducted interference measurements made on the bridge set output leads (J1 - R, S, U, M, H, and J and J2 - R, S, U, M, H, and J) covered the test frequency range of 15 kc to 25 mc as required by References 2 and 4, paragraphs 3.2.1 and 4.8.1, respectively.

A current probe, used as the pickup device, was clamped around each test lead as shown in Appendix D, Figures 21 and 22. The interference levels on each test line were recorded while the remote control unit switches (1 through 6) were sequentially operated. Data was taken to reflect the interference levels generated by the switch in the test lead circuit and also the highest interference level induced into the test lead by the actuation of the switches not in the test lead circuit.

Oscilloscope photos of the transient pulse interference were taken at 300 kc, 5.8 mc, 8.0 mc, 12 mc, and 25 mc to show the pulse characteristics and waveform.

BROADBAND RADIATED ELECTROMAGNETIC INTERFERENCE MEASUREMENTS -

Radiated interference measurements were performed on the test specimen over the frequency range of 150 kc to 400 mc in accordance with the requirements of References 2 and 4, paragraphs 3.2.2, 3.2.3, and Reference 4, Paragraph 4.7.

A 41-inch rod antenna was used as the pickup device for measurements over the frequency range of 150 kc to 25 mc, and an appropriate tuned dipole antenna was used for measurements throughout the range of 25 mc to 400 mc. The antennas were placed 1 foot from the test specimen and positioned for maximum pickup at each test frequency as shown in Figures 23 and 24.

The remote control unit switches were sequentially operated, and the recorded interference measurement was determined by the switch that generated the highest level.

RADIATED SUSCEPTIBILITY INTERFERENCE TESTS

Radiated susceptibility tests were performed on the test specimen over the frequency range of 150 kc to 10 gc in accordance with the requirements imposed by References 1, 2, and 4.

The test specimen was subjected to an RF field established by a 50-ohm signal generator driving an appropriate test antenna with a 100,000-microvolt (calculated) output modulated 30 percent at 400 cps. For tests over the frequency range of 150 kc to 25 mc, a 41-inch rod antenna was connected to the appropriate signal generator. Over the test frequency range of 25 to 1000 mc, a tuned dipole antenna was used as the radiating source. For tests covering the 1 gc-to-10 gc test frequency range, a directive microwave (horn) antenna was used to generate the RF field.

The rod antenna and tuned dipole antennas were placed 1 foot from the test specimen, and the microwave antennas were placed 3 feet from the test specimen. While the signal generator was slowly tuned throughout the test frequency range, an ammeter connected to each output lead was monitored for a current reading in excess of 5 milliamperes. The bridge set indicator meters were also monitored for any deflection. Whenever an anomaly occurred, the signal level output was reduced and the susceptibility threshold level was recorded.

TEST RESULTS

BROADBAND CONDUCTED INTERFERENCE - OUTPUT LINES

The broadband conducted interference (transient pulse) measured on bridge set output lines exceeded the limits of Reference 3 as shown in Appendix A data sheets (pages 18 through 29) and graphs in Appendix B (pages 33 through 44). The interference generated on line J1-S when switch 1 and switches 2 through 6 were actuated was within the limits of Reference 1. The frequency at which the interference level approached the limit by the least amount was at 1.4 mc. The level was determined to be 50 db above 1 microampere per megacycle bandwidth, and the specification limit at that frequency was 50 db above one-microampere per megacycle bandwidth.

The interference level on line J1-R exceeded the specification limit by the greatest amount at 8.0 mc when switch 1 was actuated. The measured level was 50 db above 1 microampere per megacycle bandwidth, and the specification limit at that frequency was 46 db above 1 microampere per megacycle bandwidth. When switches 2 through 6 were actuated, the interference on line J1-R was within the limits of Reference 1.

The interference level on lines J1-M and J1-U exceeded the specification limit by the greatest amount at 8.0 mc when switch 2 was actuated. The measured level was 57 db above 1 microampere per megacycle bandwidth, and the specification limit at that frequency was 46 db above 1 microampere per megacycle bandwidth. When switches 1 and 3 through 6 were actuated, the interference on lines J1-M and J1-U exceeded the limits of Reference 1 at 18 mc. The measured level was 47 db above 1 microampere per megacycle bandwidth on each line, and the Reference 1 limit at that frequency is 45 db above 1 microampere per megacycle bandwidth.

The interference level on lines J1-J and J1-H exceeded the specification limit by the greatest amount at 12 mc when switch 3 was actuated. The respective levels were 52 and 54 db above 1 microampere per megacycle bandwidth, and the specification limit at that frequency was 45 db above 1 microampere per megacycle bandwidth. When switches 1, 2, 4, 5, and 6 were actuated, the interference on line J1-J exceeded the limits of Reference 1 at 15 mc. The measured interference level was 49 db above 1 microampere per megacycle bandwidth, and the Reference 1 limit at that frequency is 45 db above 1 microampere per megacycle bandwidth. The interference on line J1-H exceeded the limits of Reference 1 at 15 and 18 mc when switches 1, 2, 4, 5, and 6 were actuated.

The measured interference was 46 db above 1 microampere per megacycle bandwidth, and the Reference 1 limits are 45 and 44.5 db above 1 microampere per megacycle bandwidth, respectively.

The interference level on line J2-R and J2-S exceeded the specification limit by the greatest amount at 12 mc when switch 4 was actuated. The respective levels were 68 and 65 db above one microampere per megacycle bandwidth and the specification limit at that frequency is 45 db above the 1 microampere per megacycle bandwidth. When switches 1, 2, 3, 5, and 6 were actuated, the interference on lines J2-R and J2-S was within the limits of Reference 1.

The interference on lines J2-U and J2-M exceeded the specification limit by the greatest amount at 12 mc when switch 5 was actuated. The respective interference levels were 52 and 54 db above 1 microampere per megacycle bandwidth, and the specification limit at that frequency is 45 db above 1 microampere per megacycle bandwidth. When switches 1, 2, 3, 4, and 6 were actuated, the interference on lines J2-U and J2-M was within the limits of Reference 1.

The interference level on lines J2-H and J2-J exceeded the specification limit by the greatest amount at 12 mc when switch 6 was actuated. The respective levels were 61 and 60 db above 1 microampere per megacycle bandwidth, and the specification limit at that frequency is 45 db above 1 microampere per megacycle bandwidth. When switches 1 through 5 were actuated, the interference measured on lines J2-H and J2-J was 51 db above 1 microampere per megacycle bandwidth, and on line J2-J it was 46 db above 1 microampere per megacycle bandwidth. The Reference 1 limit of this frequency is 45 db above 1 microampere per megacycle bandwidth.

BROADBAND RADIATED INTERFERENCE

The broadband radiated interference generated by the test specimen exceeded the limits of Reference 1 at 15 mc and at 33 mc. The frequency at which the specification was exceeded by the greatest amount was at 33 mc. The level was 66 db above 1 microvolt per megacycle bandwidth, and the specification limit at that frequency is 48 db above 1 microvolt per megacycle bandwidth.

RF SUSCEPTIBILITY

When the test specimen was exposed to an RF field over the frequency range of 4.3 to 400 mc established by a signal generator set for maximum output, the indicator meters on the bridge set changed erratically. The threshold susceptibility data is shown on pages 31 and 32.

With 100,000 microvolts (calculated) output from the appropriate signal generator, the test specimen failed to pass the susceptibility testing requirements of Reference 1 at the following frequencies:

Frequency (megacycles)	Susceptibility Threshold Voltage (thousands of microvolts)
19	82
25	44
26	58
28	100
29	80
30	42
32	10
33	38
56	60
70	26
75	38
80	58
90	30
100	80
160	85
200	35
210	90

The most susceptible frequency was at 32 mc, where a 10,000-microvolt output caused a deflection of all indicator meters.

Figure 20 shows the amplitude and wave characteristics of the induced RF field at 32 mc as monitored by a current probe clamped around line J1-S.

DATA CALCULATION

USING CURRENT PROBE FOR CONDUCTED INTERFERENCE MEASUREMENTS

Example:

Frequency -	15 kc
Meter reading -	26.5 db
1 kc to 1 mc conversion factor -	60.0 db
Probe correction factor -	13.0 db

Final reading = meter reading + conversion factor + probe factor = 99.5 db - ua/mc*

RADIATED INTERFERENCE USING 41-INCH ROD ANTENNA AND NF105F R1-F1 METER

Example:

Frequency -	15 mc
Meter reading -	54 db
Meter correction factor** -	-3 db
Antenna correction factor -	20.8 db

Final reading = meter reading + bandwidth + antenna factor = 71.8 db - uv/mc***

*db - ua/mc = decibel above 1 microampere per megacycle bandwidth

**Meter correction factor of -3 db = conversion from true peak to RMS peak

***db - uv/mc = decibel above 1 microvolt per megacycle bandwidth

DISCUSSION AND RECOMMENDATIONS

The source of the broadband (transient pulse) interference generated by the test specimen was the relays installed in the bridge set. To pass the conducted interference limits of Reference 1, an R-C arc suppressor (commercially available) could be installed across the contacts of each relay, or an RF filter could be installed at the bridge set output connectors (J1 and J2).

The excessive radiated interference would also be reduced by the installation of the suppressive devices and/or by improving the integrity of the shields on the input and output cables of the bridge set. The shields should be installed under each connector and should be well bonded. The susceptibility problem would be corrected by improving the cable shielding and by modifying the dummy squibs so that they are completely shielded.

CONCLUSION

The C14-354 pyrotechnic initiator checkout bridge set failed to meet the conducted interference, radiated interference, and RF susceptibility requirements of MIL-I-26600/MSC-ASPO-EMI-10A.

REFERENCES

1. MIL-I-2660/MSC-ASPO-EMI-10A, Interference Control Requirements, Aeronautical Equipment (17 October 1963).

2. MA0203-3544, Ground Support Equipment, Model C14-354, Electromagnetic Interference Test, Procedure for (4 October 1965).

3. MA0201-3939, Bridge Set, Pyrotechnic Indicator Checkout, Model C14-354, G16-821050, Functional Test, Procedure for (11 October 1965).

4. QLR 2607, Electromagnetic Interference Qualification Test Plan for Pyrotechnic Initiator Checkout Bridge Set, Model C14-354, Part G16-821050.

APPENDIX A. TABULATED DATA

CONDUCTED INTERFERENCE

(Note: Throughout the frequency range from 15 kc to 150 kc, Stoddart current probe was used. Throughout the frequency range from 150 kc to 25 mc, Empire Devices current probe was used.)

NORTH AMERICAN AVIATION, INC.
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ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N 316-821050 Serial Number 01-001	UNIT RF	LR NO.: 2607 SWA NO.:
	DATE: 12 November 1965	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA G.C.	TYPE OF EMI TEST: Broadband Conducted Using Current Probe

Frequency MC	Meter Background Noise Level DB above ua/mc	Ambient* Noise Level DB above ua/mc	Line J1-R Meter Reading DB above ua/mc	Line ** J1-R Meter Reading DB above ua/mc	Current Probe Correction Factor DB	Line J1-R Final Reading DB above ua/mc	Line J1-R ** Final Reading DB above ua/mc	MIL-I-26600/ MSC-APO-EMI-10A Spec. Limit DB-ua/mc
.015	72	72	84.0	79.6	+13.0	97.0	92.6	180
.021	69	69	83.5	77	+10.0	93.5	87.0	169
.028	64	64	88.0	65	+ 8.0	96.0	73.0	160
.035	64	64	92.0	65	+ 7.0	99.0	72.0	152
.048	64	64	85.5	65	+ 4.0	99.5	69.0	142
.058	67	67	90	67	+ 3.0	93.0	68.0	135
.065	63	63	93	67	+ 2.0	95.0	69.0	132
.090	54	54	92	66	- 0.5	91.5	65.5	121
.120	51	51	90	64	- 3.0	87	61.0	111
.150	29	29	53	33	0	53	33	104
.220	27	27	58	31	0	58	31	96
.290	27	27	63	30	0	63	30	98
.330	24	24	66	30	0	66	30	86
.370	24	24	71	32	0	71	32	82
.500	23	23	64	31	0	64	31	75
.820	24	24	59	28	0	59	28	63
.900	24	24	50	25	0	50	25	61
1.40	24	24	47	26	0	47	26	50
1.90	25	25	47	27	0	47	27	48
2.30	25	25	42	36	0	42	36	48
2.50	28	28	42	34	0	42	34	47.8
3.20	28	28	35	33	0	35	33	47.5
4.60	28	28	43	31	0	43	31	47
5.80	28	28	39	28	0	39	28	46.5
8.00	25	25	50	25	0	50	25	46
12.0	25	25	46	39	0	46	39	45.5
15.0	25	25	42	32	0	42	32	45
18.0	25	25	36	36	0	36	36	44.5
23.0	28	28	32	28	0	32	28	44
25.0	28	28	30	31	0	30	31	44

REMARKS:

* Current Probe Correction Factor not included.

** Interference Level on Line J1-R with switches 2, 3, 4, 5 and 6 actuated.

FORM 2928-J NEW 2-65

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
	UNIT RF	LR NO.: 2607 SWA NO.:
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number 01-001	DATE: 12 November 1965	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA Q.C.	TYPE OF EMI TEST: Broadband Conducted Using Current Probe

Frequency MC	Meter Background Noise Level DB above ua/mc	Ambient* Noise Level DB above ua/mc	Line J1-S Meter Reading DB above ua/mc	Line ** J1-S Meter Reading DB above ua/mc	Current Probe Correction Factor DB	J1-S Final Reading DB-ua/mc	J1-S** Final Reading DB-ua/mc	MIL-I-26600/ MSC-ASPO-EMI-10A Spec. Limit DB-ua/mc
.015	72	72	83.5	81	+13.0	96.5	94.0	180
.021	69	69	85.0	74	+10.0	95.0	84.0	169
.028	64	64	84.5	67	+ 8.0	92.5	75.0	160
.035	64	64	92.0	68	+ 7.0	99.0	75.0	152
.048	64	64	84.5	65	+ 4.0	88.0	69.0	142
.058	67	67	88.5	64	+ 3.0	91.5	67.0	135
.065	63	63	97.0	65	+ 2.0	99.0	67.0	132
.090	54	54	89.5	61	- 0.5	89	60.5	121
.120	51	51	88.0	61	- 3.0	85	58.0	111
.150	28	28	68	36	0	68	36	104
.220	27	27	72	41	0	72	41	96
.290	25	25	63	27	0	63	27	88
.330	24	24	65	24	0	65	24	86
.370	23	23	65	23	0	65	23	82
.500	23	23	62	25	0	62	25	75
.820	24	24	60	25	0	60	25	63
.900	24	24	53	26	0	53	26	61
1.40	24	24	50	26	0	50	26	50
1.90	25	25	39	27	0	39	27	48
2.30	25	25	45	27	0	45	27	48
2.50	27	27	44	28	0	44	28	47.8
3.20	28	28	39	29	0	39	29	47.5
4.60	28	28	40	30	0	40	30	47
5.80	27	27	38	29	0	38	29	46.5
8.00	25	25	30	28	0	30	28	46
12	25	25	34	28	0	34	28	45.5
15	25	25	39	34	0	39	34	45.0
18	25	25	25	25	0	25	25	44.5
23	28	28	28	28	0	28	28	44
25	28	28	30	28	0	30	28	44

REMARKS:

* Current Probe Correction Factor not included.

** Interference Level on Line J1-S with Switches 2, 3, 4, 5, and 6 actuated.

FORM 2928-J NEW 2-65

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
	UNIT RF	LR NO.: 2607 SWA NO.:
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number 01-001	DATE: 15 November 1965	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA Q.C.	TYPE OF EMI TEST: Broadband Conducted Using Current Probe

Frequency MC	Meter Background Noise Level DB above ua/mc	Ambient* Noise Level DB above ua/mc	Line J1-M Meter Reading DB above ua/mc	Line ** J1-M Meter Reading DB above ua/mc	Current Probe Correction Factor DB	Line J1-M Final Reading DB above ua/mc	Line J1-M ** Final Reading DB above ua/mc	MIL-I-26600/ MSC-ASPO-EMI-1 QA Spec. Limit DB-ua/mc
.015	72	72	87	80	+13	100	93	180
.021	69	69	85.5	76	+10	95.5	86	169
.028	64	64	85	67	+ 8	93	75	160
.035	64	64	91.5	65	+ 7	98.5	72	152
.048	64	64	92	66	+ 4	96	70	142
.058	67	67	93.5	66	+ 3	96.5	69	135
.065	63	63	93.5	68	+ 2	95.5	70	132
.090	54	54	89	67	-0.5	88.5	66.5	121
.120	54	54	91	64	-3.0	88	61	111
.150	25	25	66	36	0	66	36	104
.220	25	25	65	33	0	65	33	96
.290	25	25	64	34	0	64	34	88
.330	25	25	62	34	0	62	34	86
.370	26	26	63	34	0	63	34	82
.500	26	26	64	34	0	64	34	75
.820	25	25	62	28	0	62	28	63
.900	25	25	60	30	0	60	30	61
1.40	24	24	56	30	0	56	30	50
1.90	25	25	57	33	0	57	33	48
2.30	24	24	49	36	0	49	36	48
2.50	25	25	45	39	0	45	39	47.8
3.20	26	26	39	36	0	39	36	47.5
4.60	25	25	45	37	0	45	37	47
5.80	23	23	50	38	0	50	38	46.5
8.0	24	24	57	41	0	57	41	46
12	25	25	56	41	0	56	41	45.5
15	26	26	52	47	0	52	47	45
18	26	26	47	36	0	47	36	44.5
23	27	27	41	31	0	41	31	44
25	27	27	42	34	0	42	34	44

REMARKS:

* Current Probe Correction Factor not included.

** Interference Level on Line J1-M with switches 1, 3, 4, 5, and 6 actuated.

FORM 2928-J NEW 2-65

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
	UNIT RF	LR NO.: 2607 SWA NO.:
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number 01-001	DATE: 15 November 1965	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA Q.C.	TYPE OF EMI TEST: Broadband Conducted Using Current Probe

Frequency MC	Meter Background Noise Level DB above ua/mc	Ambient* Noise Level DB above ua/mc	Line J1-U Meter Reading DB above ua/mc	Line ** J1-U Meter Reading DB above ua/mc	Current Probe Correction Factor DB	Line J1-U Final Reading DB above ua/mc	Line J1-U ** Final Reading DB above ua/mc	MIL-I-26600/ MSC-ASPO-EMI-10A Spec. Limit DB-ua/mc
.015	72	72	85	78	+13	98	91	180
.021	69	69	87.5	76	+10	97.5	86	169
.028	64	64	87.5	67	+ 8	95.5	75	160
.035	64	64	91	64	+ 7	98	71	152
.048	64	64	90	64	+ 4	94	68	142
.058	67	67	92	67	+ 3	95	67	135
.065	63	63	92	66	+ 2	94	68	132
.090	54	54	95	66	- 0.5	94.5	65.5	121
.120	51	51	91	64	- 3.0	88	61	111
.150	28	28	70	47	0	70	47	104
.220	27	27	67	35	0	67	35	96
.290	25	25	65	37	0	65	37	88
.330	25	25	62	32	0	62	32	86
.370	26	26	67	34	0	67	34	82
.500	26	26	67	29	0	67	29	75
.820	25	25	62	28	0	62	28	63
.900	25	25	60	27	0	60	27	61
1.40	24	24	56	27	0	56	27	50
1.90	25	25	49	31	0	49	31	48
2.30	24	24	48	33	0	48	33	48
2.50	25	25	48	33	0	48	33	47.8
3.20	26	26	43	34	0	43	34	47.5
4.60	25	25	46	33	0	46	33	47
5.80	23	23	48	34	0	48	34	46.5
8.0	24	24	57	39	0	57	39	46
12.0	25	25	57	39	0	57	39	45.5
15.0	26	26	52	47	0	52	47	45
18.0	26	26	44	35	0	44	35	44.5
23.0	27	27	45	31	0	45	31	44
25.0	27	27	49	33	0	49	33	44

REMARKS:

* Current Probe Correction Factor not included.

** Interference Level on Line J1-U with switches 1, 3, 4, 5, and 6 actuated.

FORM 2928-J NEW 2-65

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
	UNIT RF	LR NO.: 2607 SWA NO.:
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number 01-001	DATE: 16 November 1965	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA Q.C.	TYPE OF EMI TEST: Broadband Conducted Using Current Probe

Frequency MC	Meter Background Noise Level DB above ua/mc	Ambient* Noise Level DB above ua/mc	Line J1-H Meter Reading DB above ua/mc	Line ** J1-H Meter Reading DB above ua/mc	Current Probe Correction Factor DB	Line J1-H Final Reading DB above ua/mc	Line ** J1-H Final Reading DB above ua/mc	MIL-I-26600/ MSC-ASPO-EMI-10A Spec. Limit DB-ua/mc
.015	72	72	86.5	79	+13	99.5	92	180
.021	69	69	84.5	76	+10	94.5	86	169
.028	64	64	86	68	+ 8	94	76	160
.035	64	64	92	68	+ 7	99	75	152
.048	64	64	89.5	67	+ 4	93.5	71	142
.058	67	67	91.5	67	+ 3	94.5	70	135
.065	63	63	92.5	65	+ 2	94.5	67	132
.090	54	54	89.5	62	- 0.5	89	61.5	121
.120	54	54	89.5	61	- 3.0	86.5	58	111
.150	25	25	73	34	0	73	34	104
.220	25	25	73	35	0	73	35	96
.290	25	25	71	34	0	71	34	88
.330	25	25	72	31	0	72	31	86
.370	26	26	70	34	0	70	34	82
.500	26	26	67	30	0	67	30	75
.820	25	25	62	27	0	62	27	63
.900	25	25	60	33	0	60	33	61
1.40	24	24	53	38	0	53	38	50
1.90	25	25	49	40	0	49	40	48
2.30	24	24	49	40	0	49	40	48
2.50	25	25	47	41	0	47	41	47.8
3.20	26	26	43	44	0	43	44	47.5
4.60	25	25	44	36	0	44	36	47.
5.80	23	23	44	36	0	44	36	46.5
8.00	24	24	51	43	0	51	43	46
12.0	25	25	54	41	0	54	41	45.5
15.0	26	26	45	46	0	45	46	45
18.0	26	26	49	46	0	49	46	44.5
23.0	27	27	31	29	0	31	29	44
25.0	27	27	42	28	0	42	28	44

REMARKS:

* Current Probe Correction Factor not included.

** Interference Level on Line J1-H with switches 1, 2, 4, 5, and 6 actuated.

FORM 2928-J NEW 2-65

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
	UNIT RF	LR NO.: 2607 SWA NO.:
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number 01-001	DATE: 15 November 1965	Broadband Conducted Using Current Probe
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA Q.C.	TYPE OF EMI TEST: Broadband Conducted Using Current Probe

Frequency MC	Meter Background Noise Level DB above ua/mc	Ambient* Noise Level DB above ua/mc	Line J1-J Meter Reading DB above ua/mc	Line ** J1-J Meter Reading DB above ua/mc	Current Probe Correction Factor DB	Line J1-J Final Reading DB above ua/mc	Line J1-J ** Final Reading DB above ua/mc	MIL-I-26600/ MSC-ASPO-EMI-10A Spec. Limit DB-ua/mc
.015	72	72	84	80	+13	97	93	180
.021	69	69	84.5	77	+10	94.5	87	169
.028	64	64	87.5	69	+ 8	95.5	77	160
.035	64	64	92	69	+ 7	99	86	152
.048	64	64	91.5	66	+ 4	95.5	70	142
.058	67	67	94.5	67	+ 3	97.5	70	135
.065	63	63	95	67	+2	97	69	132
.090	54	54	91	63	- 0.5	89.5	62.5	121
.120	54	54	91	62	- 3.0	88	59	111
.150	25	25	73	33	0	73	33	104
.220	25	25	74	37	0	74	37	96
.290	25	25	73	34	0	73	34	88
.330	25	25	71	27	0	71	27	86
.370	26	26	70	31	0	70	31	82
.500	26	26	66	28	0	66	28	75
.820	25	25	61	27	0	61	27	63
.900	28	28	61	29	0	61	29	61
1.40	24	24	59	30	0	59	30	50
1.90	25	25	53	38	0	53	38	48
2.30	24	24	47	39	0	47	39	48
2.50	25	25	48	37	0	48	37	47.8
3.20	26	26	41	38	0	41	38	47.5
4.60	25	25	42	39	0	42	39	47
5.80	23	23	47	36	0	47	36	46.5
8.0	24	24	50	41	0	50	41	46
12.0	25	25	52	42	0	52	42	45.5
15.0	26	26	46	49	0	46	49	45
18.0	26	26	40	33	0	40	33	44.5
23.0	27	27	32	27	0	32	27	44
25.0	27	27	35	27	0	35	27	44

REMARKS:

* Current Probe Correction Factor not included

** Interference Level on Line J1-J with switches 1, 2, 4, and 6 actuated.

FORM 2928-J NEW 2-65

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number 01-001	UNIT RF	LR NO.: 2607 SWA NO.:
	DATE: 16 November 1963	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA Q.C.	TYPE OF EMI TEST: Broadband Conducted Using Current Probe

Frequency MC	Meter Background Noise Level DB above ua/mc	Ambient* Noise Level DB above ua/mc	Line J2-R Meter Reading DB above ua/mc	Line ** J2-R Meter Reading DB above ua/mc	Current Probe Correction Factor DB	Line J2-R Final Reading DB above ua/mc	Line ** J2-R Final Reading DB above ua/mc	MIL-I-2600/ MSC-ASPO-EMI-10A Spec. Limit DB-ua/mc
.015	72	72	88	84	+ 13	101	97	180
.021	69	69	88	79	+ 10	98	89	169
.028	64	64	94	70	+ 8	103	78	160
.035	64	64	89	68	+ 7	96	75	152
.048	64	64	94	68	+ 4	98	72	142
.058	67	67	93.5	67	+ 3	96.5	70	135
.065	63	63	93.5	65	+ 2	95.5	67	132
.090	54	54	92.5	63	- 0.5	92	62.5	121
.120	54	54	88	59	- 3.0	85	56	111
.150	25	25	70	41	0	70	41	104
.220	25	25	71	39	0	71	39	96
.290	25	25	68	39	0	68	39	88
.330	25	25	63	32	0	63	32	86
.370	26	26	70	36	0	70	36	82
.500	26	26	65	34	0	65	34	75
.820	25	25	64	31	0	64	31	63
.900	25	25	58	28	0	58	28	61
1.40	24	24	60	29	0	60	29	50
1.90	25	25	56	36	0	56	38	48
2.30	24	24	54	38	0	54	38	48
2.50	25	25	55	39	0	55	39	47.8
3.20	26	26	48	38	0	48	38	47.5
4.60	25	25	51	36	0	51	36	47
5.80	23	23	55	37	0	55	37	46.5
8.00	24	24	60	40	0	60	40	46
12.0	25	25	68	38	0	68	38	45.5
15.0	26	26	55	40	0	55	40	45
18.0	26	26	53	43	0	53	43	44.5
23.0	27	27	42	30	0	42	30	44
25.0	27	27	45	36	0	45	36	44

REMARKS:

* Current Probe Correction Factor not included.
** Interference Level on Line J1-H with switches 1, 2, 3, 5, and 6 actuated.

FORM 2928-J NEW 2-65

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number 01-001	UNIT RF	LR NO.: 2607 SWA NO.:
	DATE: 17 November 1965	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA Q.C.	TYPE OF EMI TEST: Broadband Conducted Using Current Probe

Frequency MC	Meter Background Noise Level DB above ua/mc	Ambient* Noise Level DB above ua/mc	Line J2-S Meter Reading DB above ua/mc	Line J2-S ** Meter Reading DB above ua/mc	Current Probe Correction Factor DB	Line J2-S Final Reading DB above ua/mc	Line J2-S ** Final Reading DB above ua/mc	MIL-I-26600/ MSC-ASPO-EMI-10A Spec, Limit DB-ua/mc
.015	72	72	87.5	82	+13.0	100.5	95	180
.021	69	69	85	78	+10.0	95	88	169
.028	64	64	99	69	+ 8.0	107	77	160
.035	64	64	90	67	+ 7.0	97	74	152
.048	64	67	96	68	+ 4.0	100	72	142
.058	67	67	91.5	66	+ 3.0	94.5	69	135
.065	63	63	93	65	+ 2.0	95	67	132
.090	54	54	89.5	63	- 0.5	89	62.5	121
.120	54	54	86	59	- 3.0	83	56	111
.150	25	25	72	41	0	72	41	104
.220	25	25	71	39	0	71	39	96
.290	25	25	70	36	0	70	36	88
.330	25	25	67	35	0	67	35	86
.370	26	26	68	37	0	68	37	82
.500	26	26	65	33	0	65	33	75
.820	25	25	62	31	0	62	31	63
.900	25	25	60	29	0	60	29	61
1.40	24	24	59	29	0	59	29	50
1.90	25	25	56	33	0	56	33	48
2.30	24	24	52	36	0	52	36	48
2.50	25	25	49	37	0	49	37	47.8
3.20	26	26	42	41	0	42	41	47.5
4.60	25	25	44	37	0	44	37	47
5.80	23	23	50	35	0	50	35	46.5
8.00	24	24	53	41	0	53	41	46
12.0	25	25	65	40	0	65	40	45.5
15.0	26	26	50	36	0	50	36	45
18.0	26	26	50	44	0	50	44	44.5
23.0	27	27	41	29	0	41	29	44
25.0	27	27	46	35	0	46	35	44

REMARKS:

* Current Probe Correction Factor not included

** Interference Level on Line J2-S with switches 1, 2, 3, 5 and 6 actuated.

FORM 2928-J NEW 2-65

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
	UNIT RF	LR NO.: 2607 SWA NO.:
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number C1-001	DATE: 16 November 1965	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA Q.C.	TYPE OF EMI TEST: Broadband Conducted Using Current Probe

Frequency MC	Meter Background Noise Level DB above ua/mc	* Ambient Noise Level DB above ua/mc	Line J2-M Meter Reading DB above ua/mc	Line ** J2-M Meter Reading DB above ua/mc	Current Probe Correction Factor DB	Line J2-M Final Reading DB above ua/mc	Line J2-M ** Final Reading DB above ua/mc	MIL-I-26600/ MSC-ASPO-EMI-10A Spec. Limit DB-ua/mc
.015	72	72	85	80	+13	98	93	180
.021	69	69	87	73	+10	97	83	169
.028	64	64	88	68	+ 8	96	76	160
.035	64	64	91	69	+ 7	98	76	152
.048	64	64	92	64	+ 4	96	68	142
.058	67	67	93	61	+ 3	96	64	135
.065	63	63	96	65	+ 2	98	67	132
.090	54	54	94.5	61	- 0.5	94	60.5	121
.120	54	54	92	57	- 3.0	89	54	111
.150	25	25	75	41	0	75	41	104
.220	25	25	72	41	0	72	41	96
.290	25	25	70	38	0	70	38	88
.330	25	25	66	36	0	66	36	86
.370	26	26	67	37	0	67	37	82
.500	26	26	66	36	0	66	36	75
.820	25	25	62	34	0	62	34	63
.900	25	25	56	29	0	56	29	61
1.40	24	24	56	27	0	56	27	50
1.90	25	25	51	33	0	51	33	48
2.30	24	24	48	34	0	48	34	48
2.50	25	25	45	35	0	45	35	47.8
3.20	26	26	37	37	0	37	37	47.5
4.60	25	25	40	35	0	40	35	47
5.80	23	23	42	31	0	42	31	46.5
8.00	24	24	48	35	0	48	35	46
12.0	25	25	54	40	0	54	40	45.5
15.0	26	26	44	42	0	44	42	45
18.0	26	26	43	40	0	43	40	44.5
23.0	27	27	29	27	0	29	27	44
25.0	27	27	37	35	0	37	35	44

REMARKS:

* Current Probe Correction Factor not included.

** Interference Level on Line J2-M with switches 1, 2, 3, 4 and 6 actuated.

FORM 2928-J NEW 2-65

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
	UNIT RF	LR NO.: 2607 SWA NO.:
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number 01-001.	DATE: 17 November 1965	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA Q.C.	TYPE OF EMI TEST: Broadband Conducted Using Current Probe

Frequency MC	Meter Background Noise Level DB above ua/mc	* Ambient Noise Level DB above ua/mc	Line J2-U Meter Reading DB above ua/mc	Line J2-U ** Meter Reading DB above ua/mc	Current Probe Correction Factor DB	Line J2-U Final Reading DB above ua/mc	Line J2-U ** Final Reading DB above ua/mc	MIL-I-26600/ MSC-ASPO-EMI-10A Spec. Limit DB-ua/mc
.015	72	72	87.5	84	+13	100.5	97	180
.021	69	69	86.5	75	+10	96.5	85	169
.028	64	64	92	67	+ 8	100.0	75	160
.035	64	64	92	67	+ 7	99.0	74	152
.048	64	64	93.5	66	+ 4	97.5	70	142
.058	67	67	96	66	+ 3	99.0	69	135
.065	63	63	95	66	+ 2	97.0	68	132
.090	54	54	93.5	61	- .5	93.0	60.5	121
.120	54	54	91	59	- 3.0	88.0	56.0	111
.150	25	25	77	44	0	77	44	104
.220	25	25	73	43	0	73	43	96
.290	25	25	72	40	0	72	40	88
.330	25	25	70	41	0	70	41	86
.370	26	26	70	41	0	70	41	82
.500	26	26	69	35	0	69	35	75
.820	25	25	62	31	0	62	31	63
.900	25	25	61	33	0	61	33	61
1.40	24	24	55	27	0	55	27	50
1.90	25	25	53	29	0	53	29	48
2.30	24	24	49	44	0	49	44	48
2.50	25	25	48	43	0	48	43	47.8
3.20	26	26	38	40	0	38	40	47.5
4.60	25	25	39	41	0	39	41	47
5.80	23	23	42	41	0	42	41	46.5
8.0	24	24	49	35	0	49	35	46
12.0	25	25	52	31	0	52	31	45.5
15.0	26	26	44	33	0	44	33	45
18.0	26	26	45	27	0	45	27	44.5
23.0	27	27	33	29	0	33	29	44
25.0	27	27	43	34	0	43	34	44

REMARKS:

* Current Probe Correction Factor not included.

** Interference Level on Line J2-U with switches 1, 2, 3, 4 and 6 actuated.

FORM 2928-J NEW 2-65

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
	UNIT RF	LR NO.: 2607 SWA NO.:
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number C1-001	DATE: 17 November 1965	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA Q.C.	TYPE OF EMI TEST: Broadband Conducted Using Current Probe

Frequency MC	Meter Background Noise Level DB above ua/mc	* Ambient Noise Level DB above ua/mc	Line J2-H Meter Reading DB above ua/mc	Line J2-H ** Meter Reading DB above ua/mc	Current Probe Correction Factor DB	Line J2-H Final Reading DB above ua/mc	Line J2-H ** Final Reading DB above ua/mc	MIL-I-26600/ MSC-ASPO-EMI-10A Spec. Limit DB-ua/mc
.015	72	72	90	81	+13	103	94	180
.021	69	69	92	73	+10	102	83	169
.028	64	64	85	70	+ 8	93	78	160
.035	64	64	89	69.5	+ 7	96	66.5	152
.048	64	64	94	63.5	+ 4	98	67.5	142
.058	67	67	86.5	64.5	+ 3	89.5	67.5	135
.065	63	63	88	66	+ 2	90	68	132
.090	54	54	84.5	65.5	- 0.5	84	65	121
.120	54	54	83.5	64	- 3.0	80.5	61	111
.150	25	25	72	39	0	72	39	104
.220	25	25	72	39	0	72	39	96
.290	25	25	70	38	0	70	38	88
.330	25	25	69	33	0	69	33	86
.370	26	26	68	33	0	68	33	82
.500	26	26	66	32	0	66	32	75
.820	25	25	61	28	0	61	28	63
.900	25	25	56	27	0	56	27	61
1.40	24	24	56	26	0	56	26	50
1.90	25	25	53	32	0	53	32	48
2.30	24	24	49	35	0	49	35	48
2.5	25	25	47	36	0	47	36	47.8
3.20	26	26	42	38	0	42	38	47.5
4.60	25	25	39	36	0	39	36	47
5.80	23	23	49	35	0	49	35	46.5
8.00	24	24	56	38	0	56	38	46
12.0	25	25	61	45	0	61	45	45.5
15.0	26	26	53	51	0	53	51	45
18.0	26	26	50	34	0	50	34	44.5
23.0	27	27	40	30	0	40	30	44
25.0	27	27	42	33	0	42	33	44

REMARKS:

* Current Probe Correction Factor not included.

** Interference Level on Line J2-H with switches 1, 2, 3, 4 and 5 actuated.

FORM 2928-J NEW 2-65

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number 01-001	UNIT RF	LR NO.: 2607 SWA NO.:
	DATE: 18 November 1965	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA Q.C.	TYPE OF EMI TEST: Broadband Conducted Using Current Probe

Frequency MC	Meter Back-Ground Noise Level DB above ua/mc	Ambient Noise Level DB above ua/mc	* Line J2-J Meter Reading DB above ua/mc	** Line J2-J Meter Reading DB above ua/mc	Current Probe Correction Factor DB	Line J2-J Final Reading DB above ua/mc	** Line J2-J Final Reading DB above ua/mc	MIL-I-26600/ MSC-ASPO-EMI-10A Spec. Limit DB-ua/mc
.015	72	72	88	79.5	+ 13	101	92.5	180
.021	69	69	93	77	+ 10	103	87	169
.028	64	64	84.5	65	+ 8	92.5	73	160
.035	64	64	92	64.5	+ 7	97	71.5	152
.048	64	64	92	65	+ 4	96	69	142
.058	67	67	84	65.5	+ 3	87	68.5	135
.065	63	63	85	67.5	+ 2	87	69.5	132
.090	54	54	90	66.5	- 0.5	89.5	66	121
.120	54	54	86	64	- 3.0	83	61	111
.150	25	25	76	39	0	76	39	104
.220	25	25	74	37	0	74	37	96
.290	25	25	70	35	0	70	35	88
.330	25	25	68	34	0	68	34	86
.370	26	26	67	36	0	67	36	82
.500	26	26	66	31	0	66	31	75
.820	25	25	62	27	0	62	27	63
.900	25	25	60	28	0	60	28	61
1.40	24	24	57	28	0	57	28	50
1.90	25	25	52	32	0	52	32	48
2.30	24	24	45	35	0	45	35	48
2.50	25	25	46	36	0	46	36	47.8
3.20	26	26	39	34	0	39	34	47.5
4.60	25	25	50	32	0	50	32	47
5.80	23	23	50	32	0	50	32	46.5
8.00	24	24	55	35	0	55	35	46
12.0	25	25	60	42	0	60	42	45.5
15.0	26	26	49	46	0	49	46	45
18.0	26	26	46	39	0	46	39	44.5
23.0	27	27	37	26	0	37	26	44
25.0	27	27	38	27	0	38	27	44

REMARKS:

* Current Probe Correction Factor not included.

** Interference Level on Line J2-J with switches 1, 2, 3, 4, and 5 actuated.

FORM 2928-J NEW 2-65

RADIATED INTERFERENCE

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
	UNIT RF	LR NO.: 2607 SWA NO.:
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number 01-001	DATE: 19 November 1965	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA Q.C	TYPE OF EMI TEST: Broadband Radiated

Frequency MC	Meter Background Noise Level DB above uv/mc	Ambient Noise Level DB above uv/mc	Meter Reading DB above uv/mc	Antenna Correction Factor DB	Corrected Background Noise Level-DB above uv/mc	Final Meter Reading DB above uv/mc		MIL-I-26600/ MSC-ASPO-EMI-10A Spec. Limit DB-uv/mc
.15	28	28	28	35.0	63	63		79
.22	29	29	29	35.2	64	64		74.6
.29	29	29	29	35.5	65	65		73.1
.33	30	30	30	33.2	63	63		72.4
.37	24	24	24	33.5	58	58		72.2
.50	24	24	24	34.2	58	58		70
.82	24	24	24	30.5	54	54		69.5
.90	26	26	26	31.0	57	57		69.4
1.4	26	26	26	27.2	53	53		69
1.9	25	25	25	28.2	53	53		68.6
2.3	26	26	26	23.8	50	50		68.4
2.5	27	27	27	24.0	51	51		68.4
3.2	26	26	26	24.5	50	50		68
4.6	26	26	26	21.3	47	47		67.7
5.8	23	23	37	21.8	45	59		67.5
6.5	24	24	30	22.0	46	52		67.4
8.0	25	25	26	22.8	48	49		67.2
12.0	25	25	29	20	45	49		66.7
12.5	25	25	37	20.5	46	58		66.7
15.0	31	31	51	20.8	52	72		66.5
18.0	33	33	51	15.0	48	66		66.3
23.0	32	32	50	16.0	48	66		66.1
25.0	30	30	45	16.2	46	61		66
33.0	26	26	55	8	34	63		49
40.0	25	25	37	8	33	45		50.5
53.0	27	27	31	9	36	40		51.3
75.0	26	26	35	9	35	44		52.5
105.0	29	29	37	9	38	46		53.5
165.0	26	26	33	9	35	42		54.9
230.0	26	26	27	9	35	36		56
270	26	26	31	9	35	40		56.4
320	26	26	27	10	37	37		57
400	27	27	27	10	37	37		57.7

REMARKS: 1. Final Readings rounded off to nearest DB.

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RF SUSCEPTIBILITY THRESHOLD DATA

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO.
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number 01-001.	UNIT RF	LR NO.: 2607 SWA NO.:
	DATE: 22 November 1965	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA, Q.C.	TYPE OF EMI TEST: RF Radiated Susceptibility

Frequency MC	Radiated Level Micro-volts							MIL-I-26600/ MSC-ASPO-EMI-10A SPEC. LIMIT MICROVOLTS
.150 to 4.30	1000k	41" Rod Antenna	NO CHANGE IN OPERATION OF TEST SPECIMEN					100k
4.30	980k		METERS ON BRIDGE SET DEFLECTED					
5.0	720k							
5.8	780k							
6.5	430k							
7.0	140k							
7.5	140k							
8.0	240k							
8.5	270k							
10.0	340k							
19.0	82k*							
20	430k							
22	150k							
25	44k*							
26	58k*	Dipole Ant. Tuned to 35 MC						
27	140k							
29	80k*							
30	42k*							
32	10k*							
33	38k*							
34	120k							
35	170k							

REMARKS:

1. Radiated Level reflects the open circuit output from the 50 ohm Signal Generator driving the appropriate rod, tuned dipole, and directional antenna.

* Indicates out-of-spec condition.

FORM 2928-J NEW 2-65

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTROMAGNETIC COMPATIBILITY DATA SHEET

TEST TITLE: EMI QUALIFICATION TEST OF APOLLO C14-354 PYROTECHNIC INITIATOR CHECK-OUT BRIDGE SET	DEPT. 098-322	TEST REPORT NO. SID 65-1673
	UNIT RF	LR NO.: 2607 SWA NO.:
TEST SPECIMEN: C14-354 Pyrotechnic Initiator Check-out Bridge Set, P/N G16-821050 Serial Number 01-001	DATE: 22 November 1965	
TEST PERFORMED BY: RESP. ENG.: W. Holsborg TECH.:	WITNESSED BY: R. Kelso, NAA, Q.C.	TYPE OF EMI TEST: RF Radiated Susceptibility

Frequency MC	Radiated Level Micro-volts							MIL-I-26600/ MSC-ASPO-EMI-10A SPEC. LIMIT MICROVOLTS
36 to 50	250k	Dipole Antenna Tuned to Test Freq.		METERS ON BRIDGE SET DEFLECTED				100k
52	160k							
54	120k*							
56	60k*							
70	26k*							
75	38k*							
80	58k*							
90	30k*							
100	30k*							
120	80k*							
160	85k*							
200	35k*							
210	110k							
220	120k							
350	250k							
400	300k							
410 to 1000	500k			NO CHANGE IN OPERATION OF TEST SPECIMEN				
1200 to 10,000	500k	Directional Antenna						

REMARKS:

1. Radiated Level reflects the open circuit output from the 50 ohm Signal Generator driving the appropriate antenna.

* Indicates out-of-spec condition.

FORM 2928-J NEW 2-65

APPENDIX B. GRAPHIC PRESENTATION OF TEST DATA

CONDUCTED INTERFERENCE MEASUREMENTS

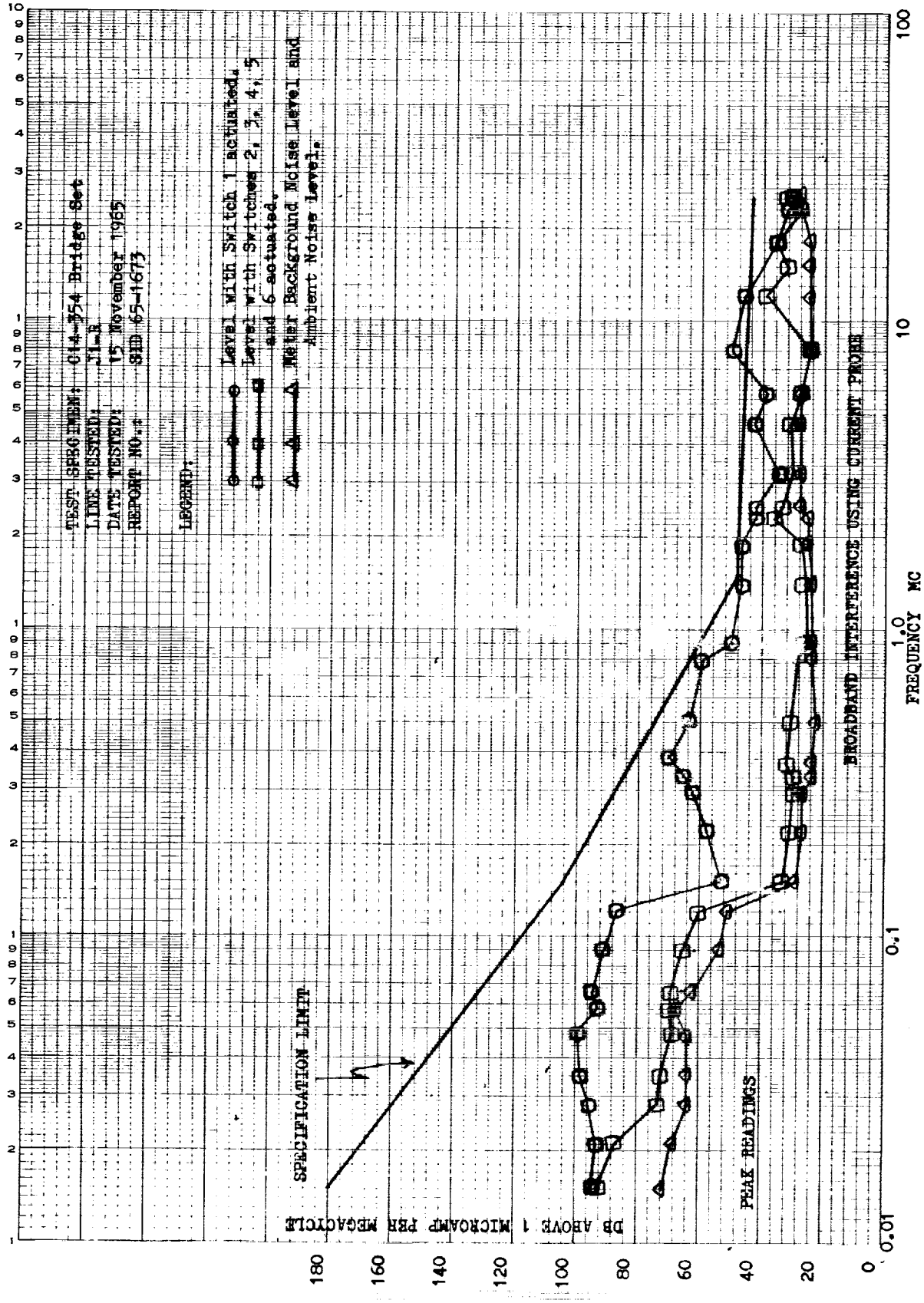


Figure 1. Broadband Conducted Interference Using Current Probe, Line J1-R

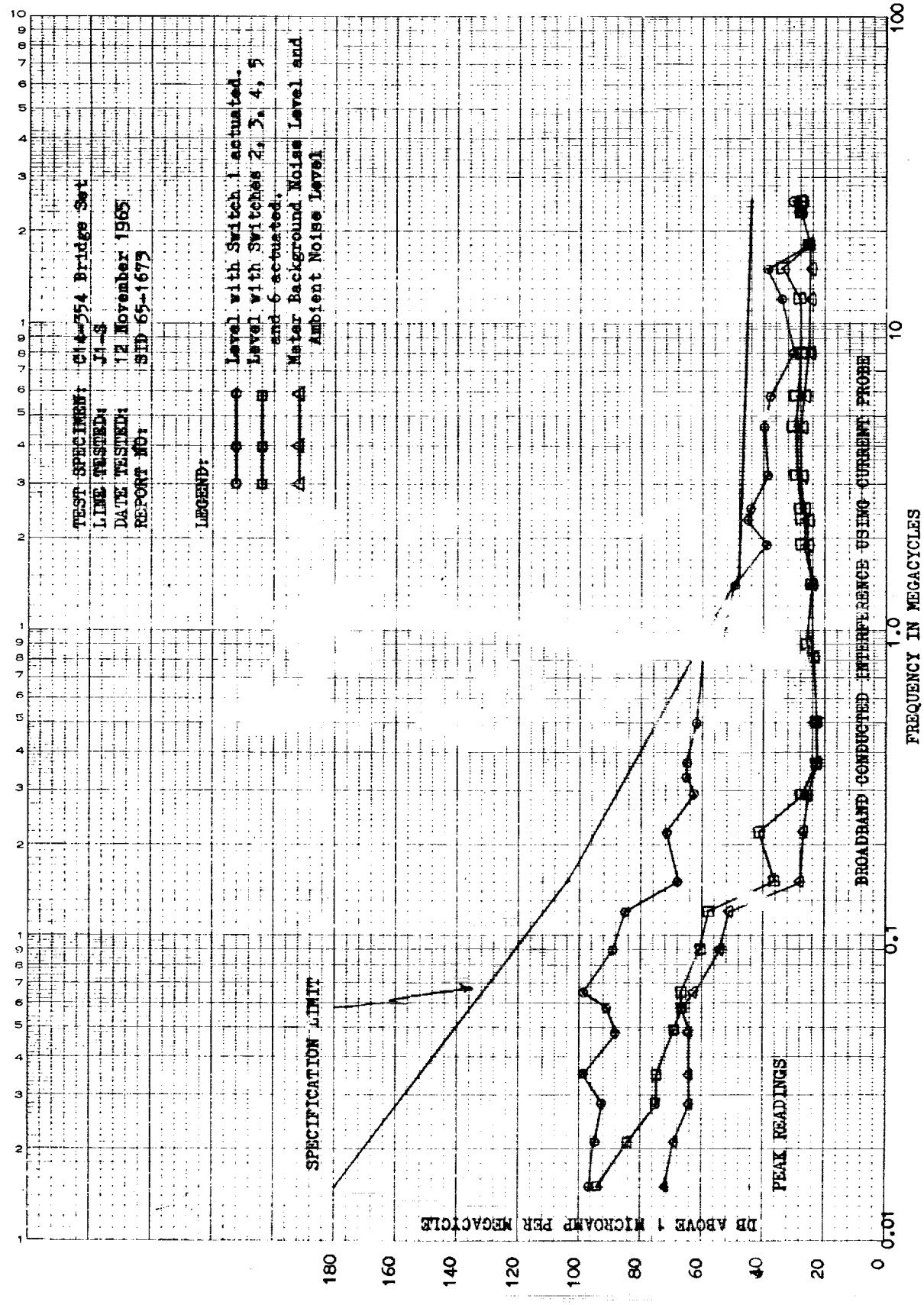


Figure 2. Broadband Conducted Interference Using Current Probe, Line J1-S

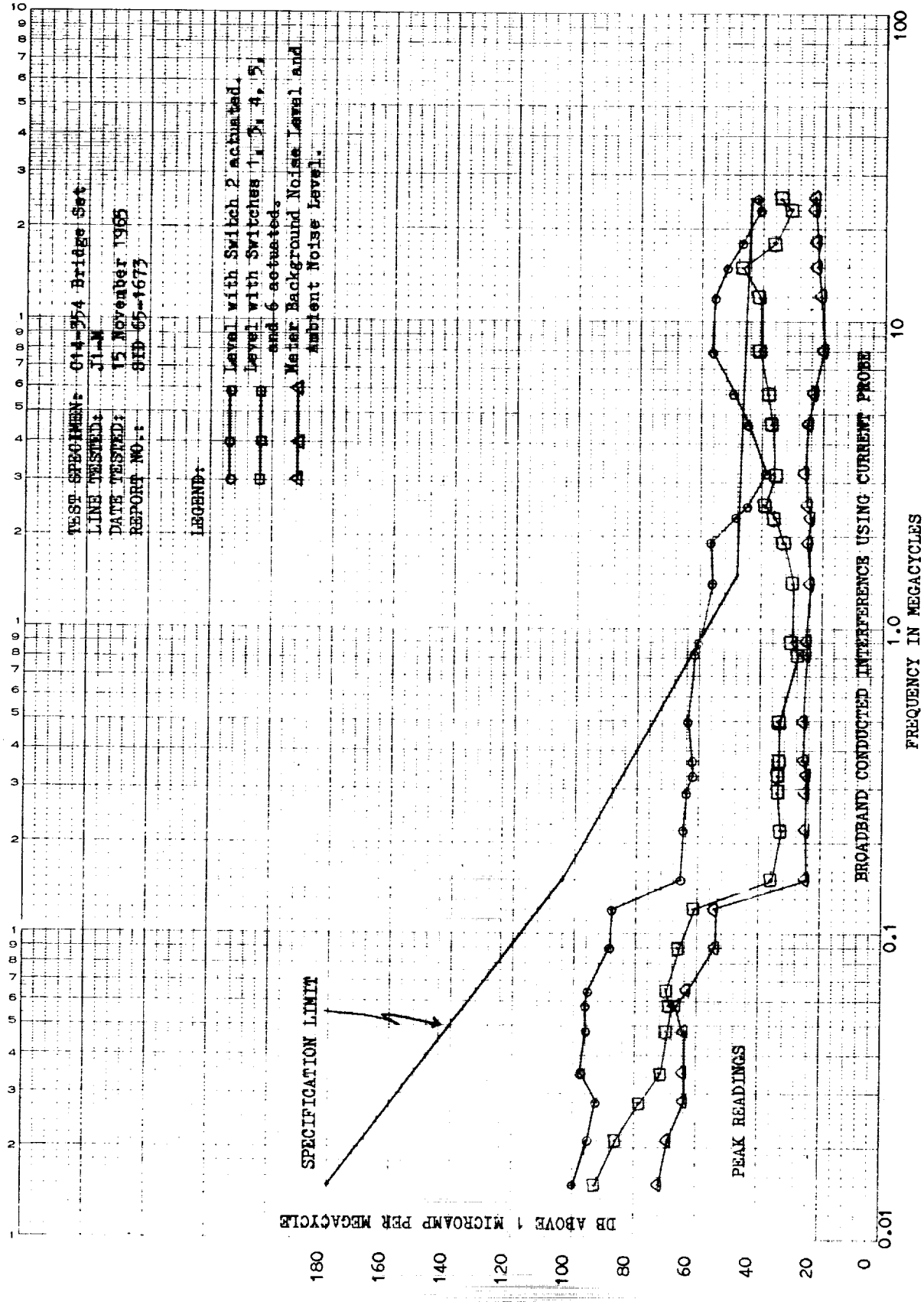


Figure 3. Broadband Conducted Interference Using Current Probe, Line J1-M

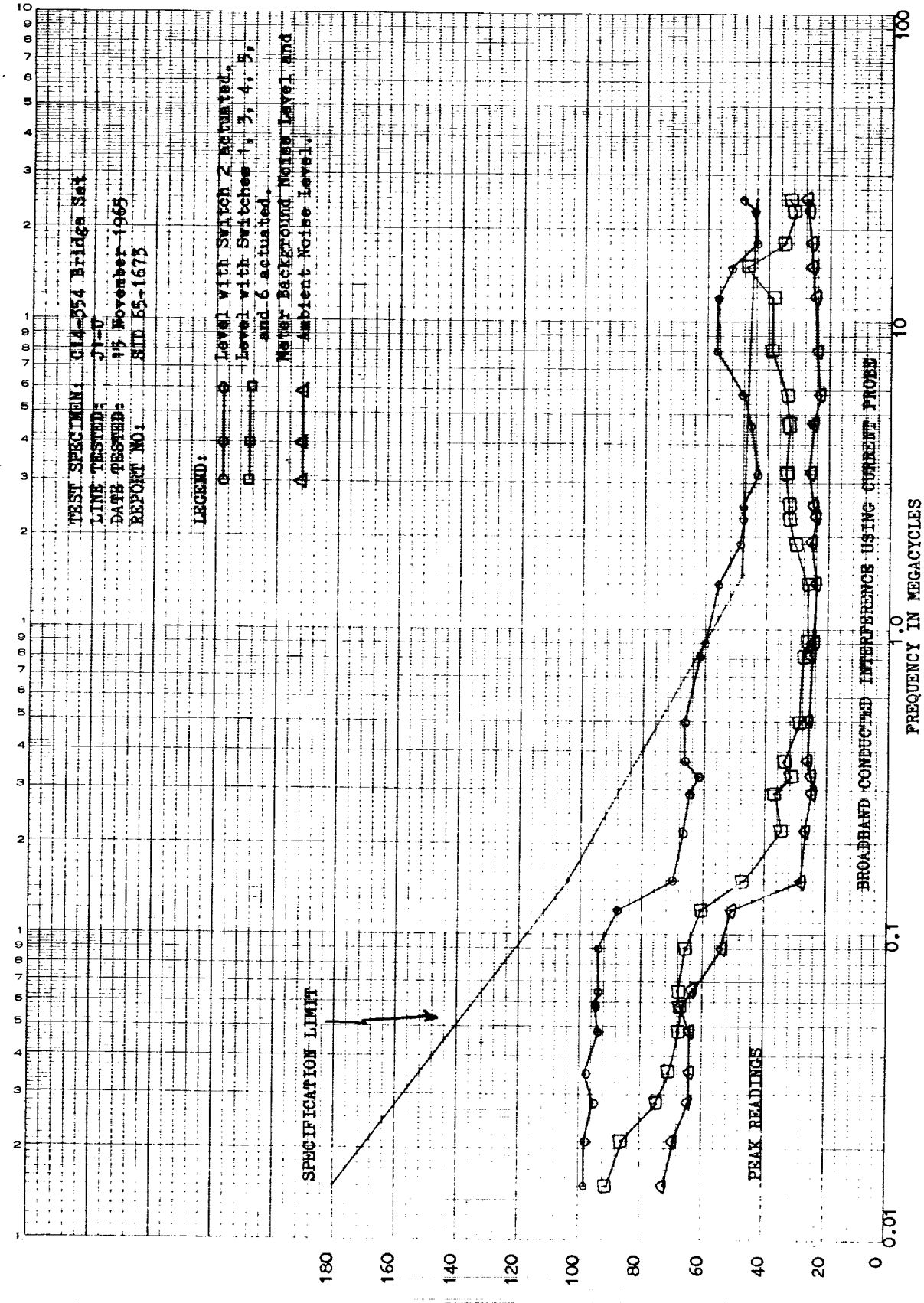


Figure 4. Broadband Conducted Interference Using Current Probe, Line J1-U

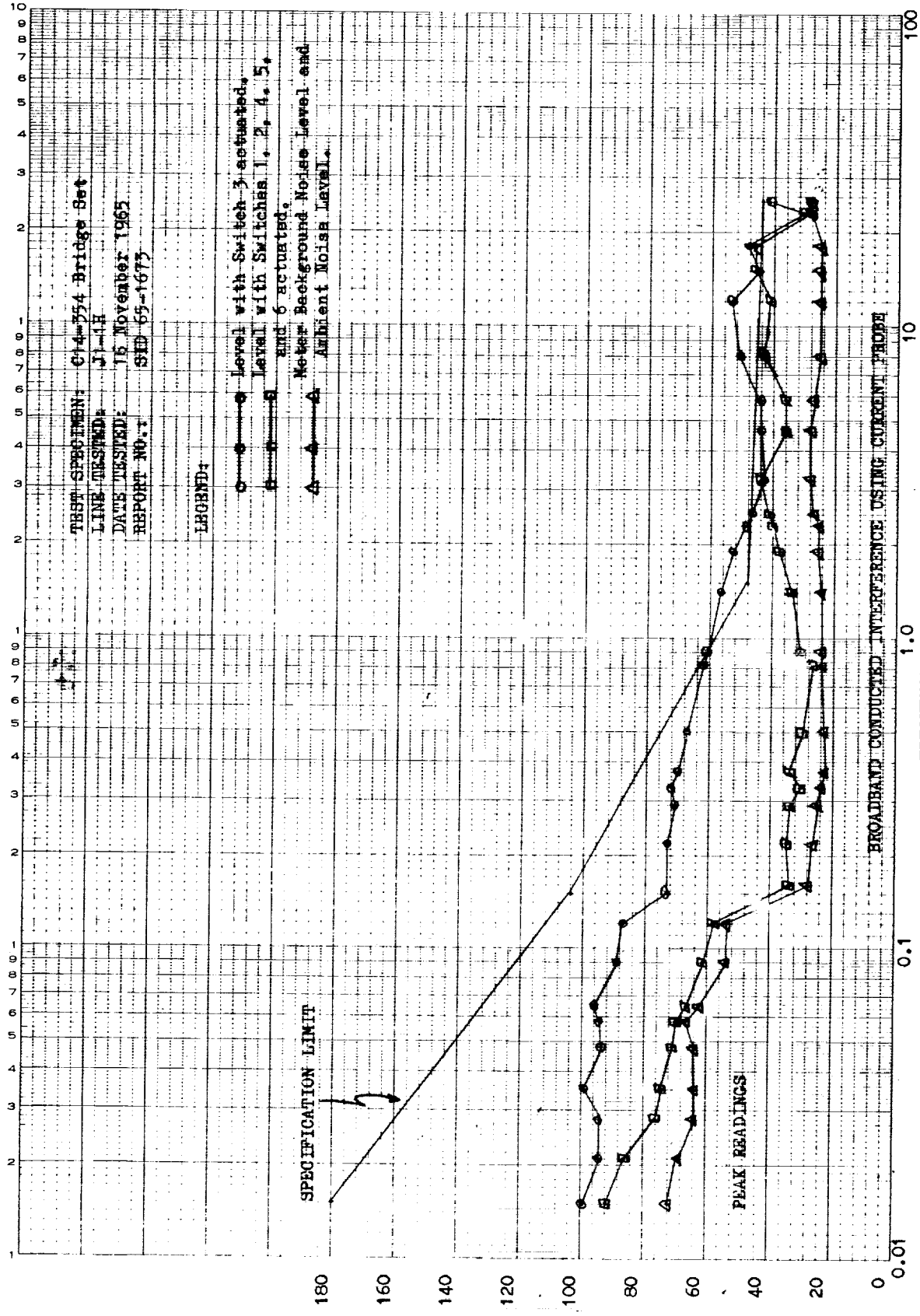


Figure 5. Broadband Conducted Interference Using Current Probe, Line J1-1H

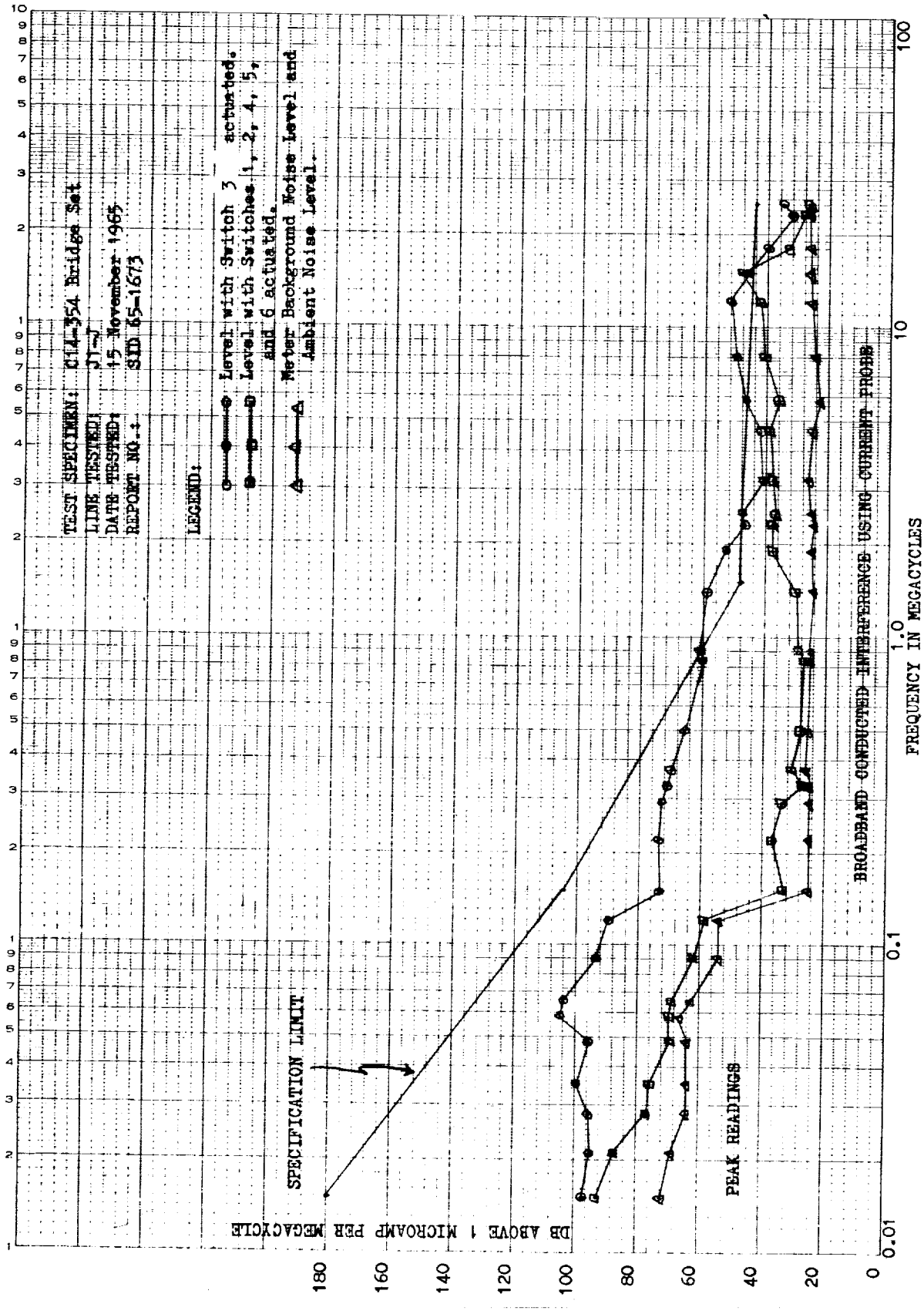


Figure 6. Broadband Conducted Interference Using Current Probe, Line J1-J

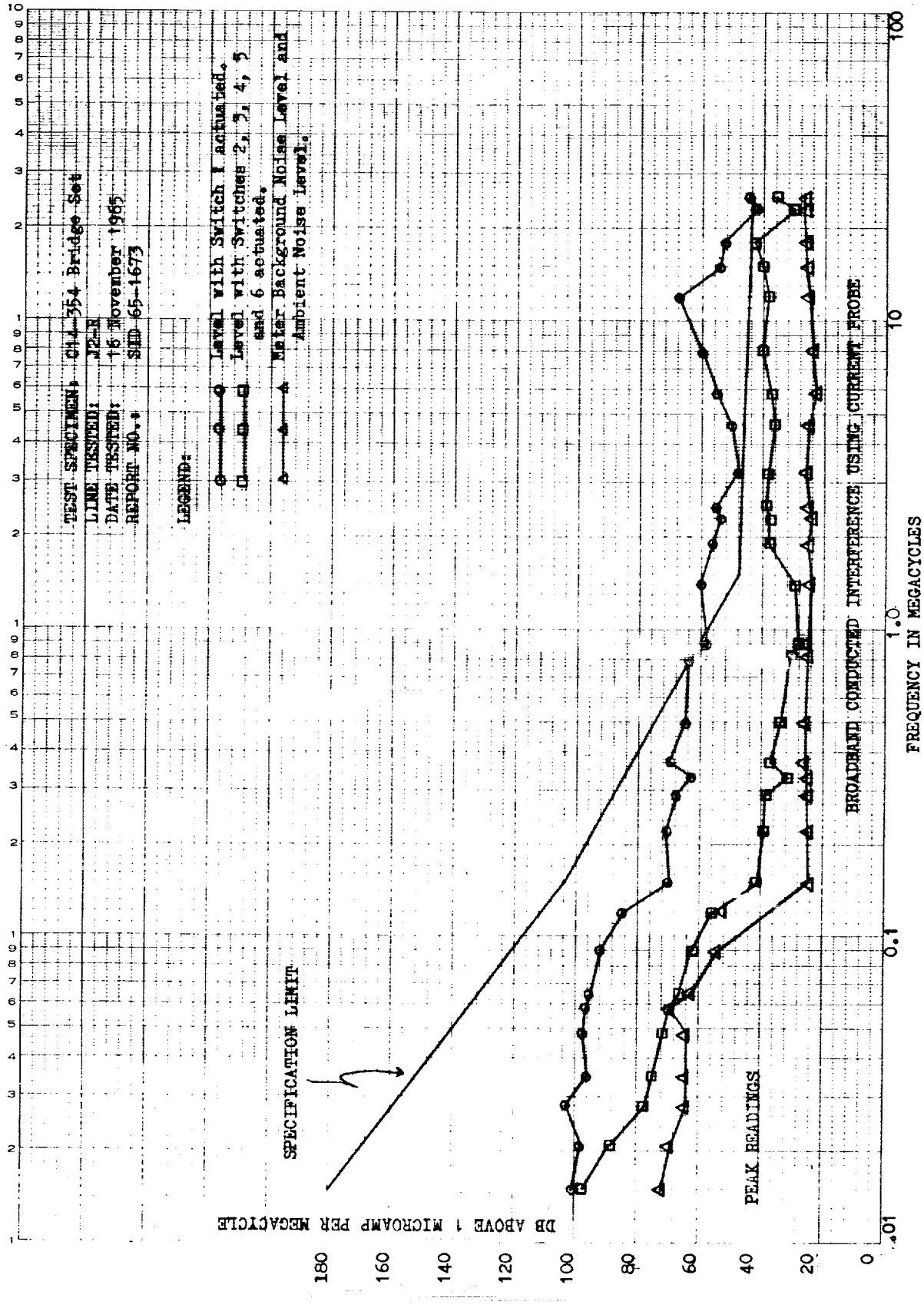


Figure 7. Broadband Conducted Interference Using Current Probe, Line J2-R

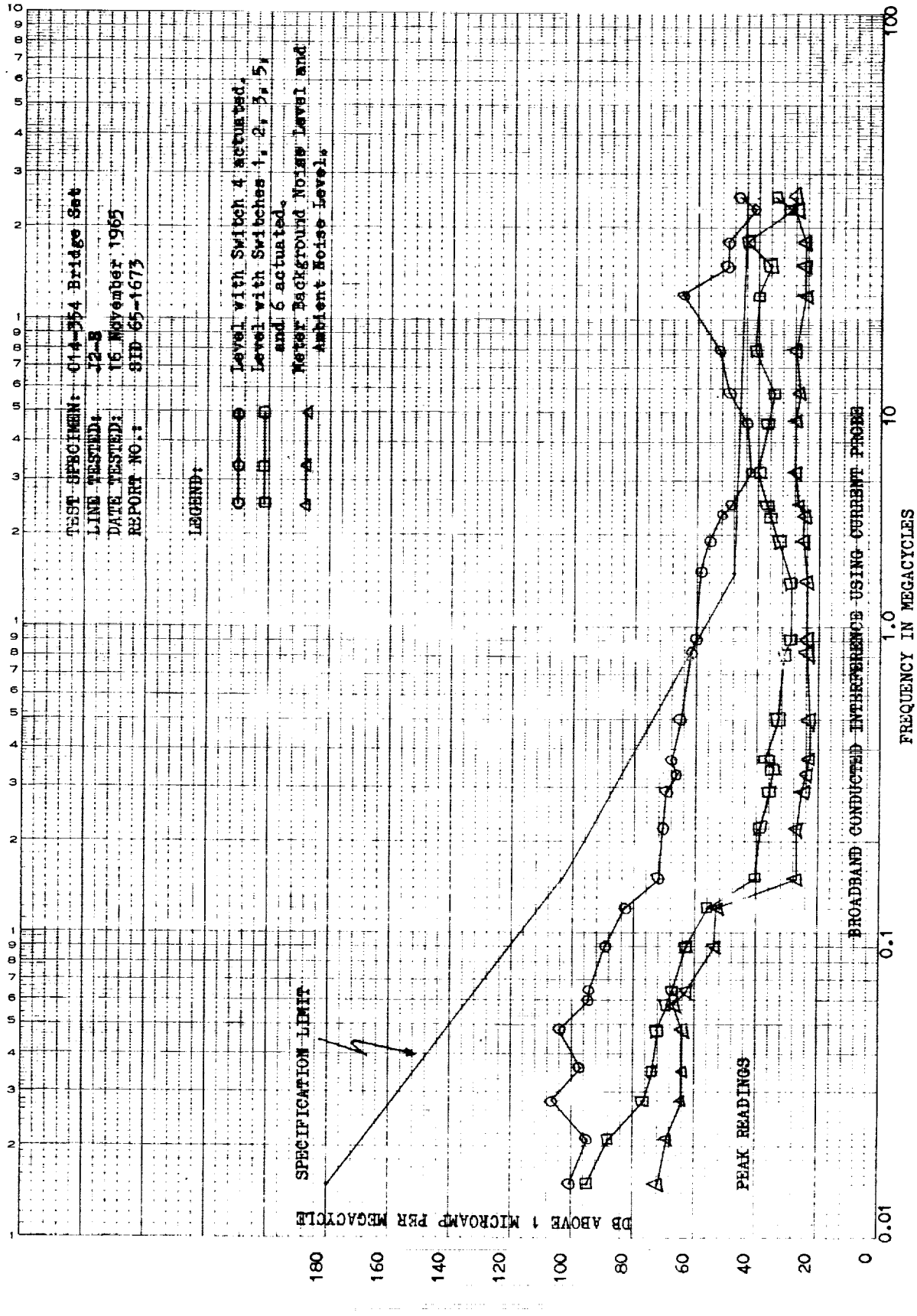


Figure 8. Broadband Conducted Interference Using Current Probe, Line J2-S

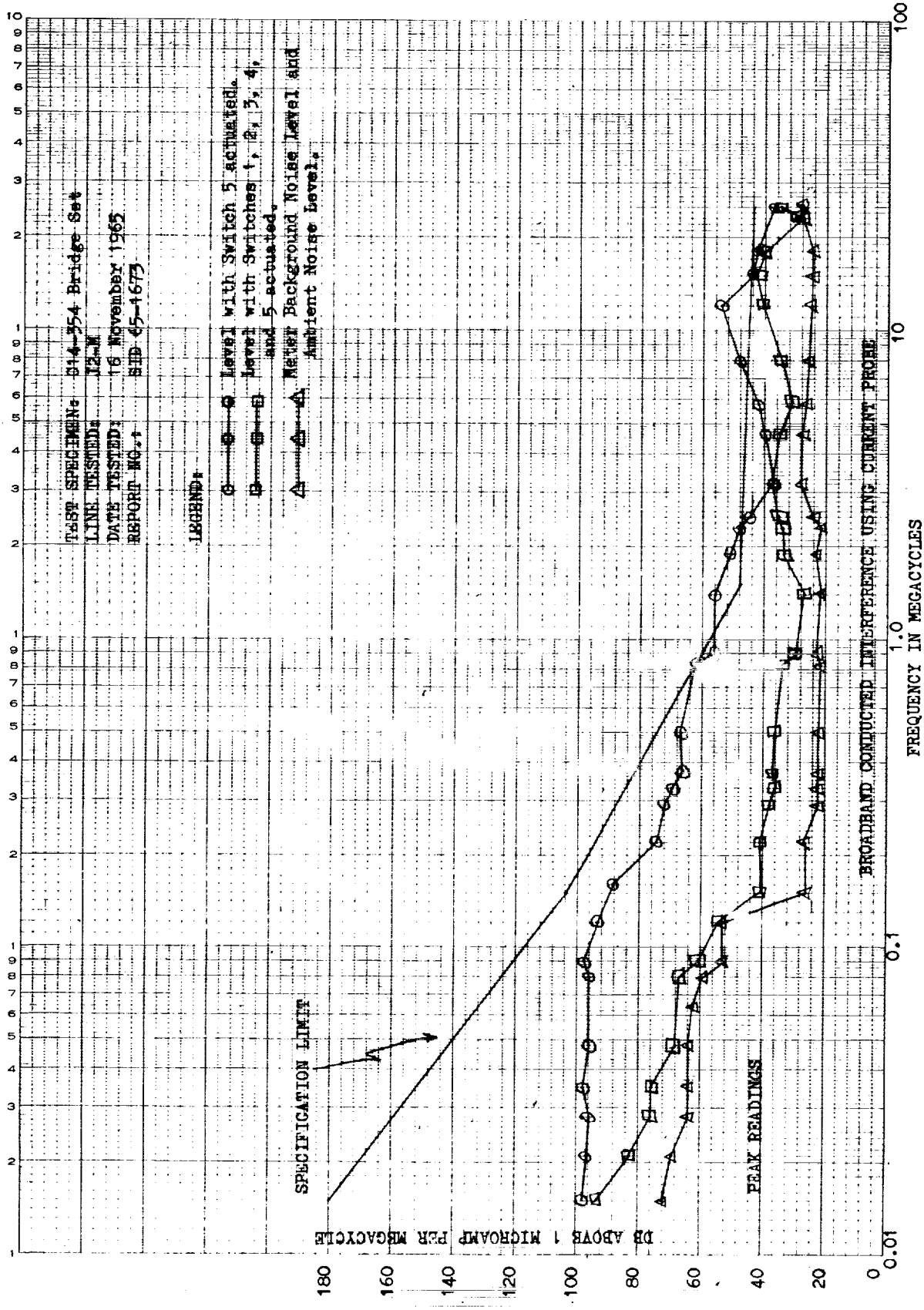


Figure 9. Broadband Conducted Interference Using Current Probe, Line J2-M

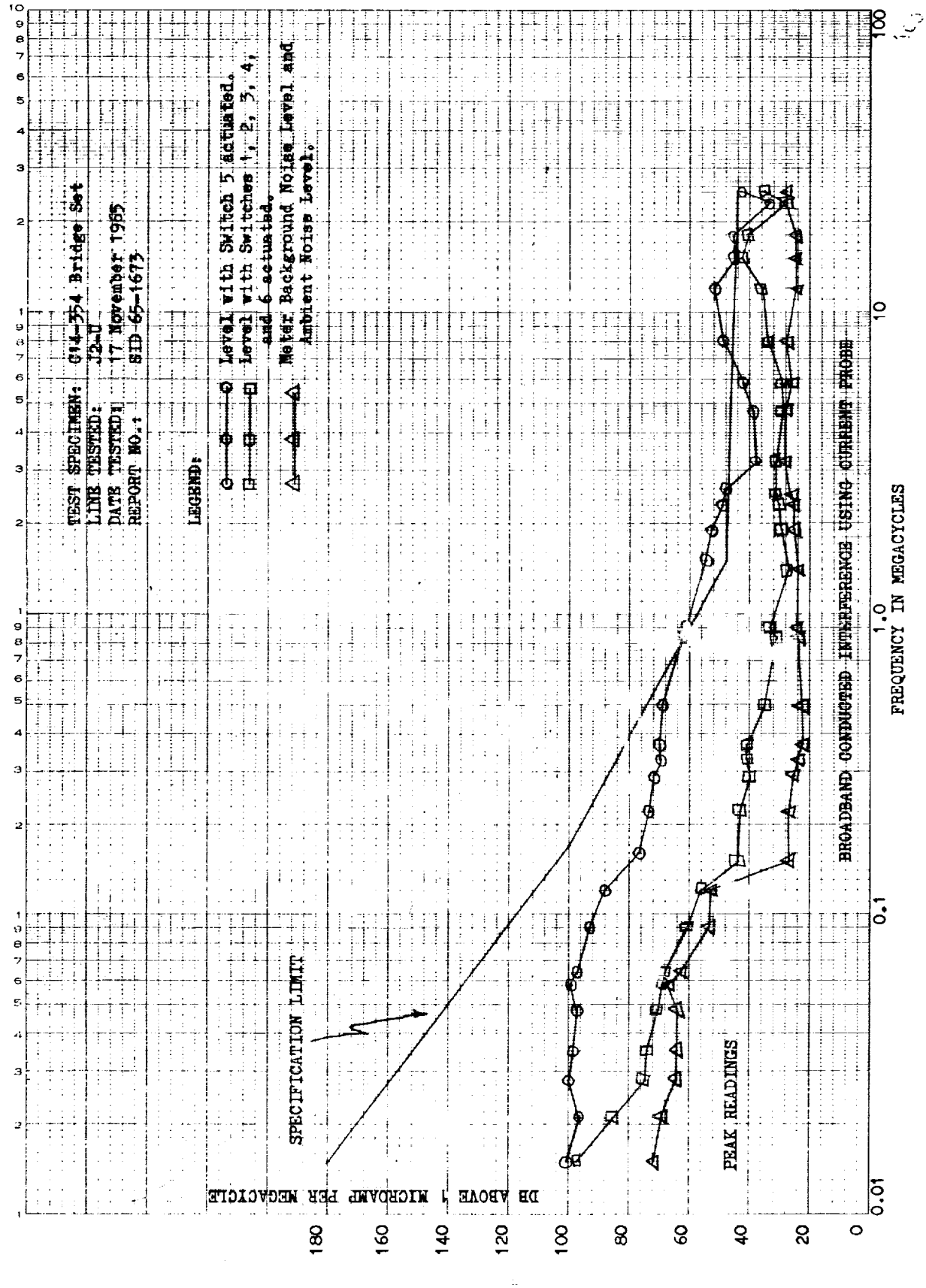


Figure 10. Broadband Conducted Interference Using Current Probe, Line J2-U

10.

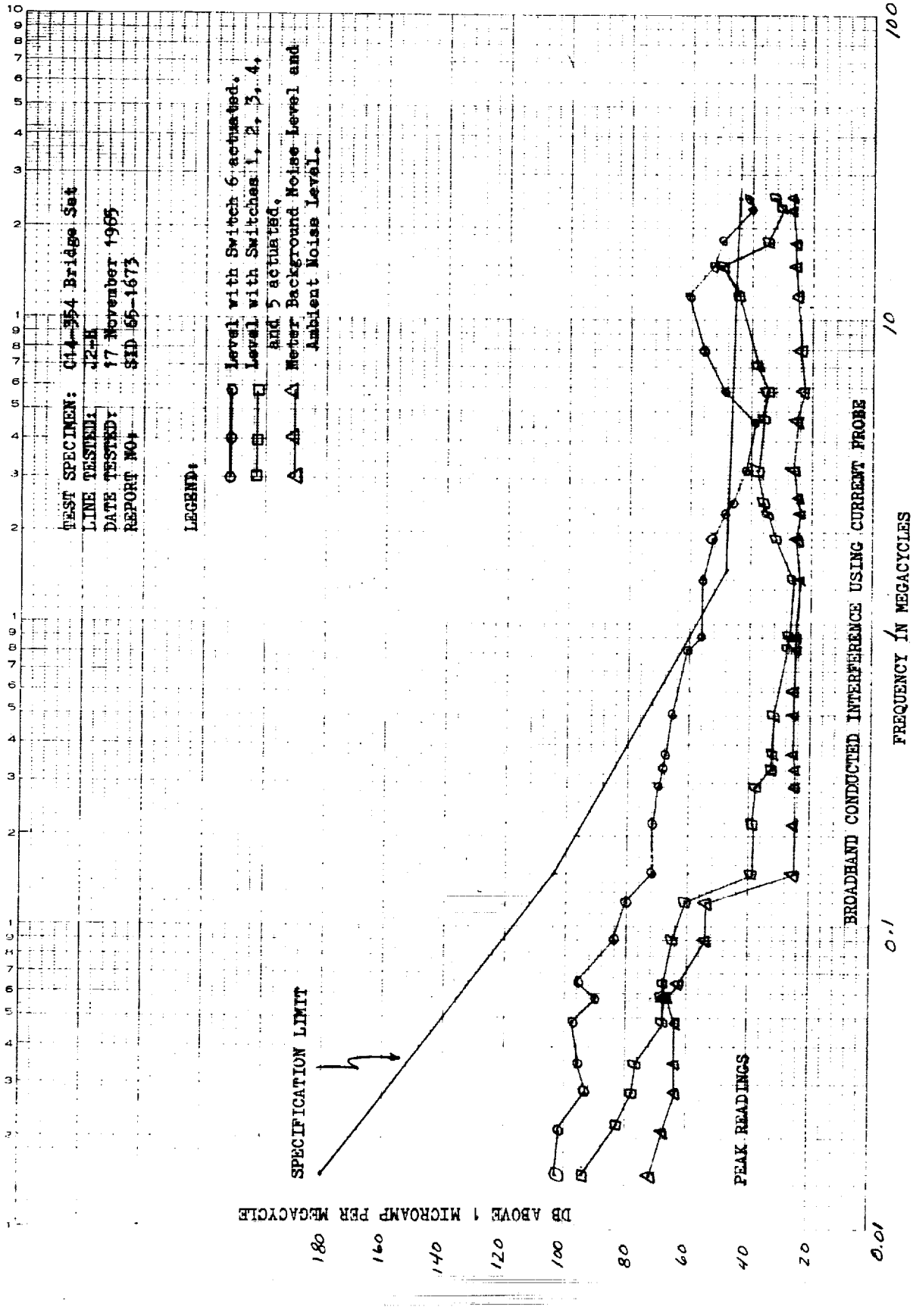


Figure 11. Broadband Conducted Interference Using Current Probe, Line J2-H

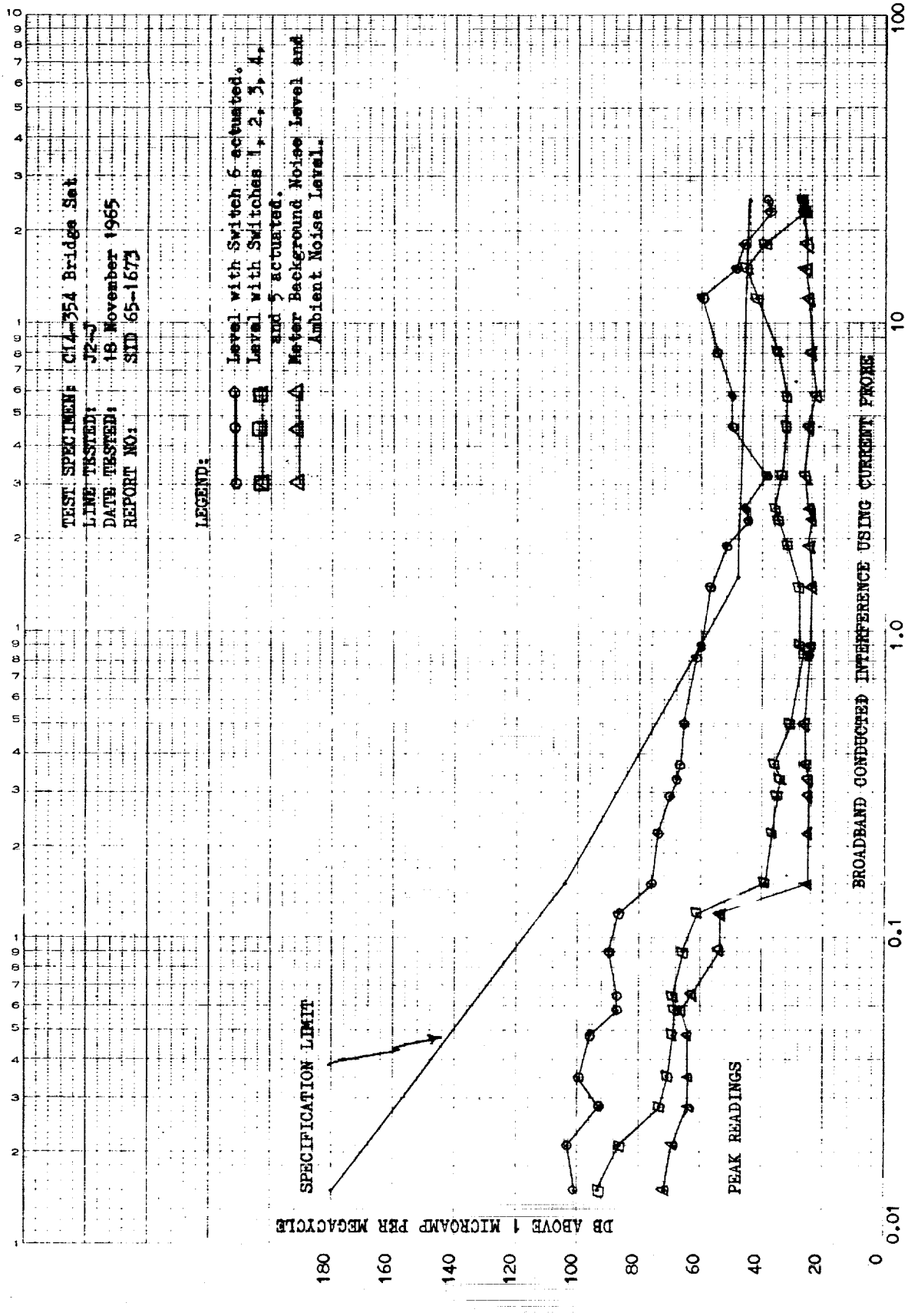


Figure 12. Broadband Conducted Interference Using Current Probe, Line J2-J

RADIATED INTERFERENCE MEASUREMENTS

SID 65-1673

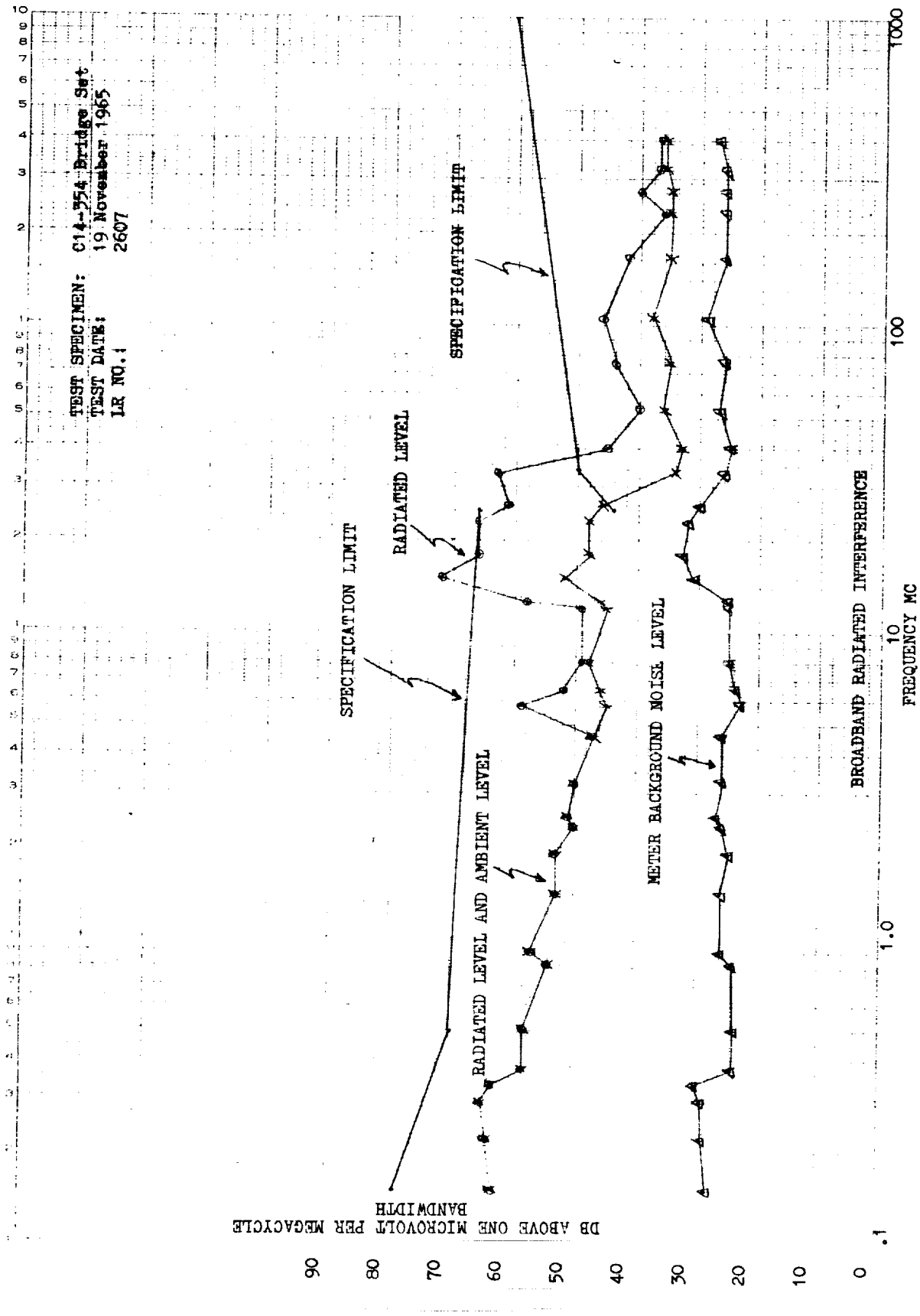
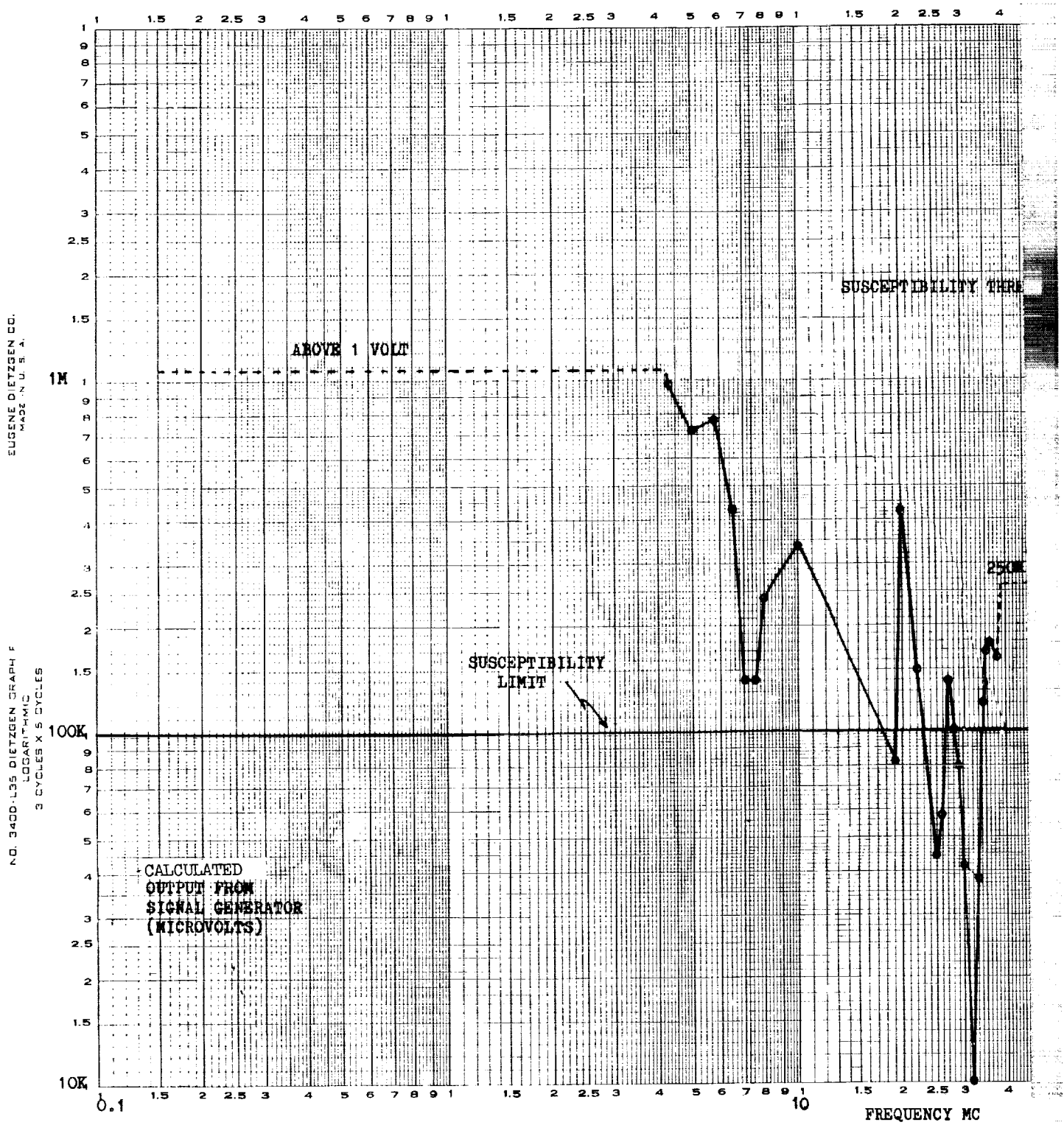


Figure 13. Broadband Radiated Interference

SUSCEPTIBILITY PROFILE

NORTH



FOLDOUT FRAME /

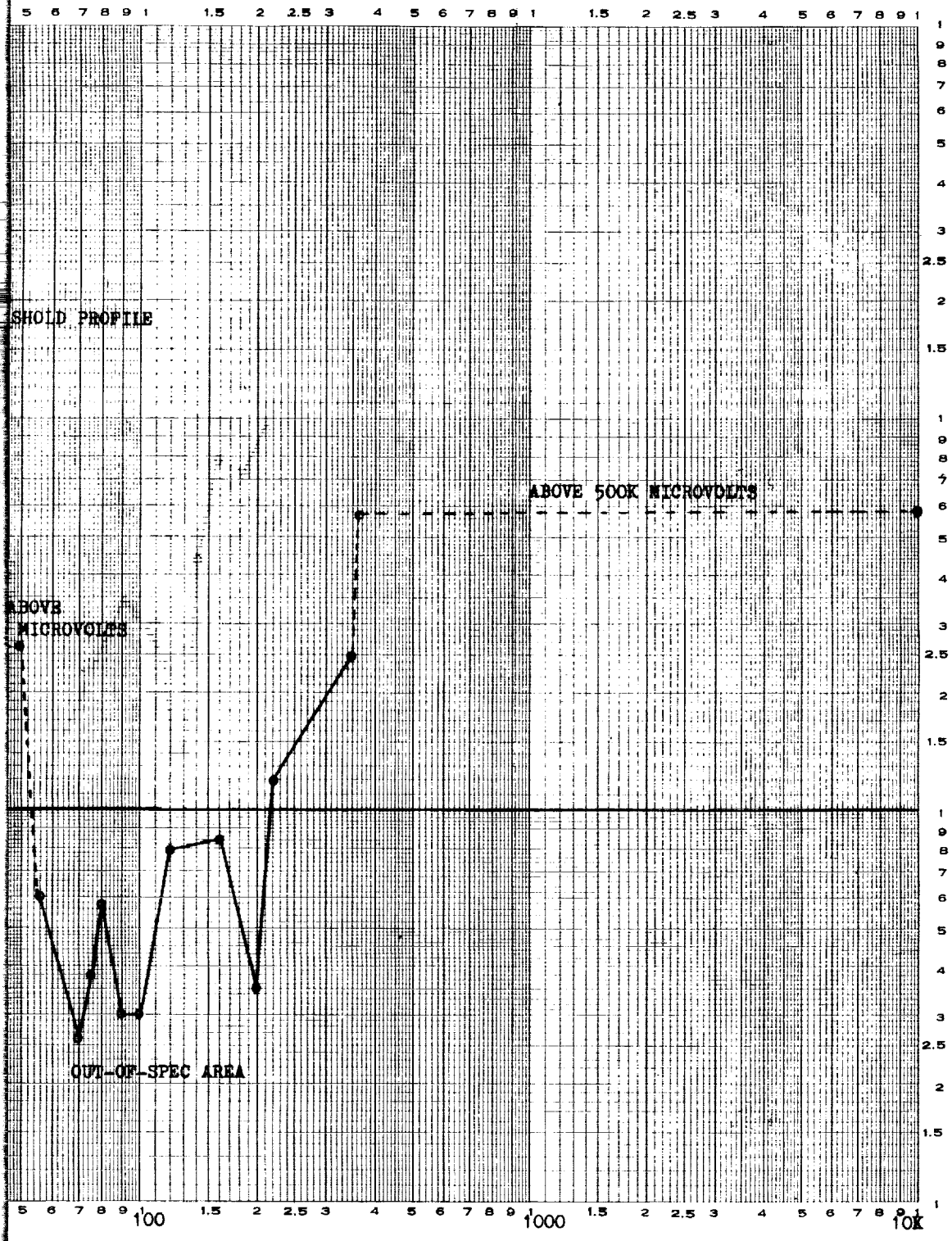
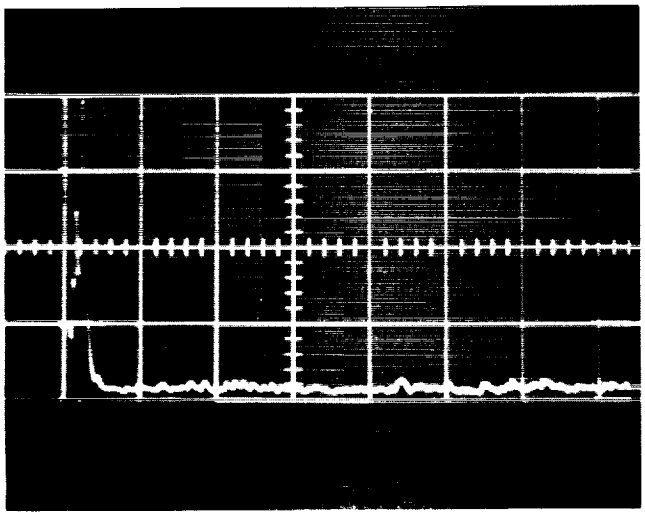


Figure 14. Susceptibility Threshold Profile

FOLDOUT FRAME 2

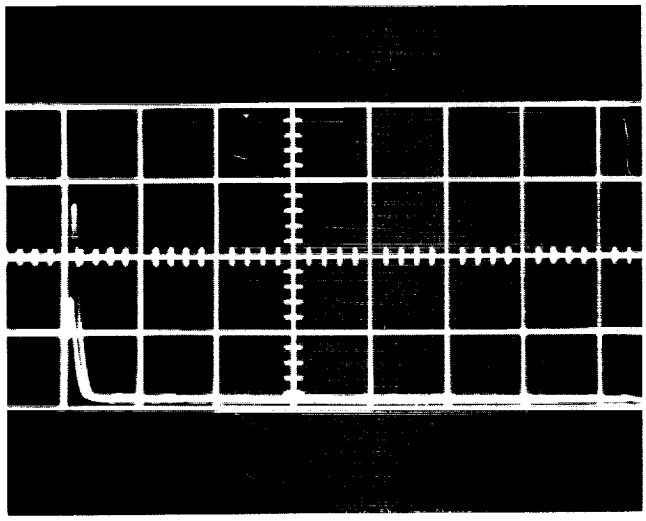
APPENDIX C.
OSCILLOSCOPE PHOTOS OF INTERFERENCE DATA

CONDUCTED INTERFERENCE ON OUTPUT LINES



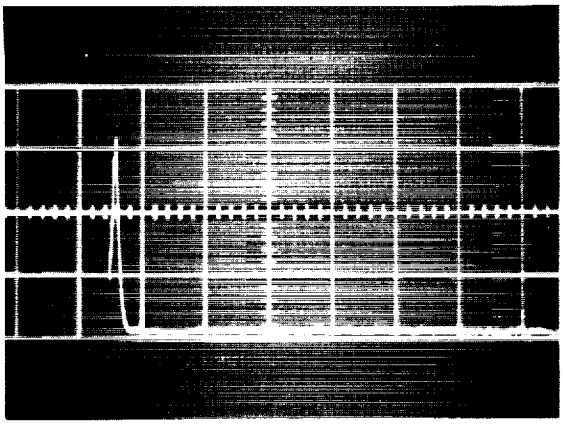
71 db above one microamp/mc
Sweep rate: 1 millisecond/cm
Amplitude: 0.5 volt/cm

Figure 15. Transient Pulse at 330 kc on Line J1-J



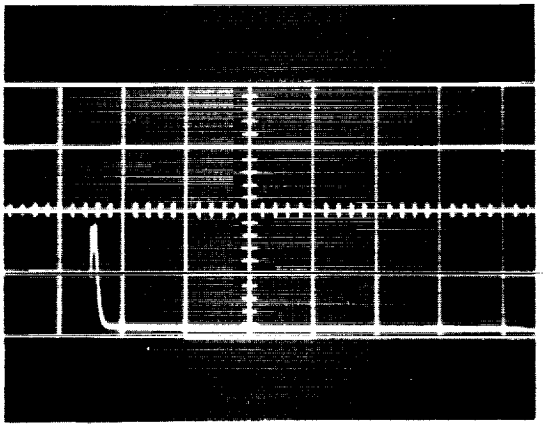
38 db above one microamp/mc
Sweep Rate: 1 millisecond/cm
Amplitude: 0.5 volt/cm

Figure 16. Transient Pulse at 5.8 mc on Line J1-S



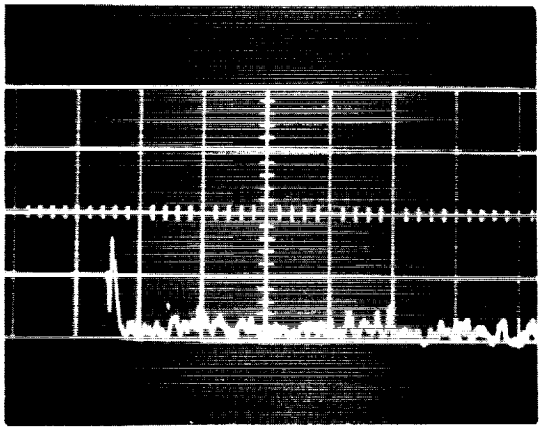
60 db above one microamp/mc
Sweep Rate: 1 millisecond/cm
Amplitude: 0.5 volt/cm

Figure 17. Transient Pulse at 8.0 mc on Line J2-R



68 db above one microamp/mc
Sweep Rate: 1 millisecond/cm
Amplitude: 0.5 volt/cm

Figure 18. Transient Pulse at 12.0 mc on Line J2-R

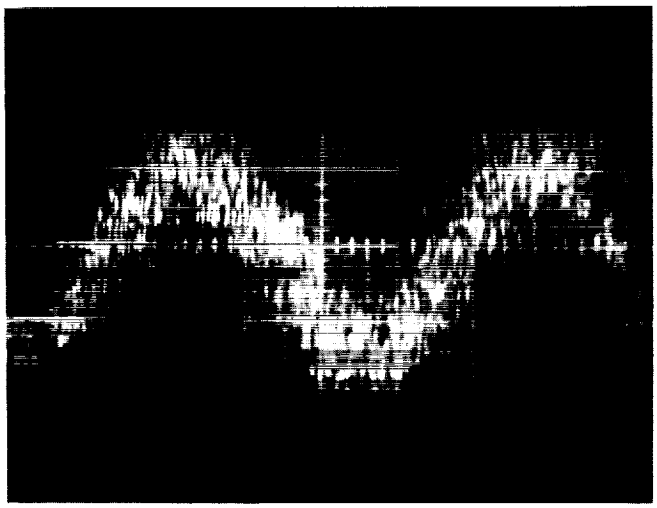


45 db above one microamp/mc
Sweep Rate: 1 millisecond/cm
Amplitude: 0.5 volt/cm

Figure 19. Transient Pulse at 25 mc on Line J2-R

RF INTERFERENCE INDUCED ON OUTPUT LINE DURING RADIATED SUSCEPTIBILITY TEST

SID 65-1673



Internal Sweep Magnifier: X10
Sweep Rate: 5 milliseconds/cm
Amplitude: 0.2 volt/cm

Figure 20. RF-Radiated Susceptibility Test, 32-mc (400-Cycle Modulation) Induced on Line J1-S—Current Probe Pickup

APPENDIX D. TEST SETUPS

CONDUCTED INTERFERENCE TEST SETUP

Figure 21. Conducted Interference Test Setup Using Current Probe

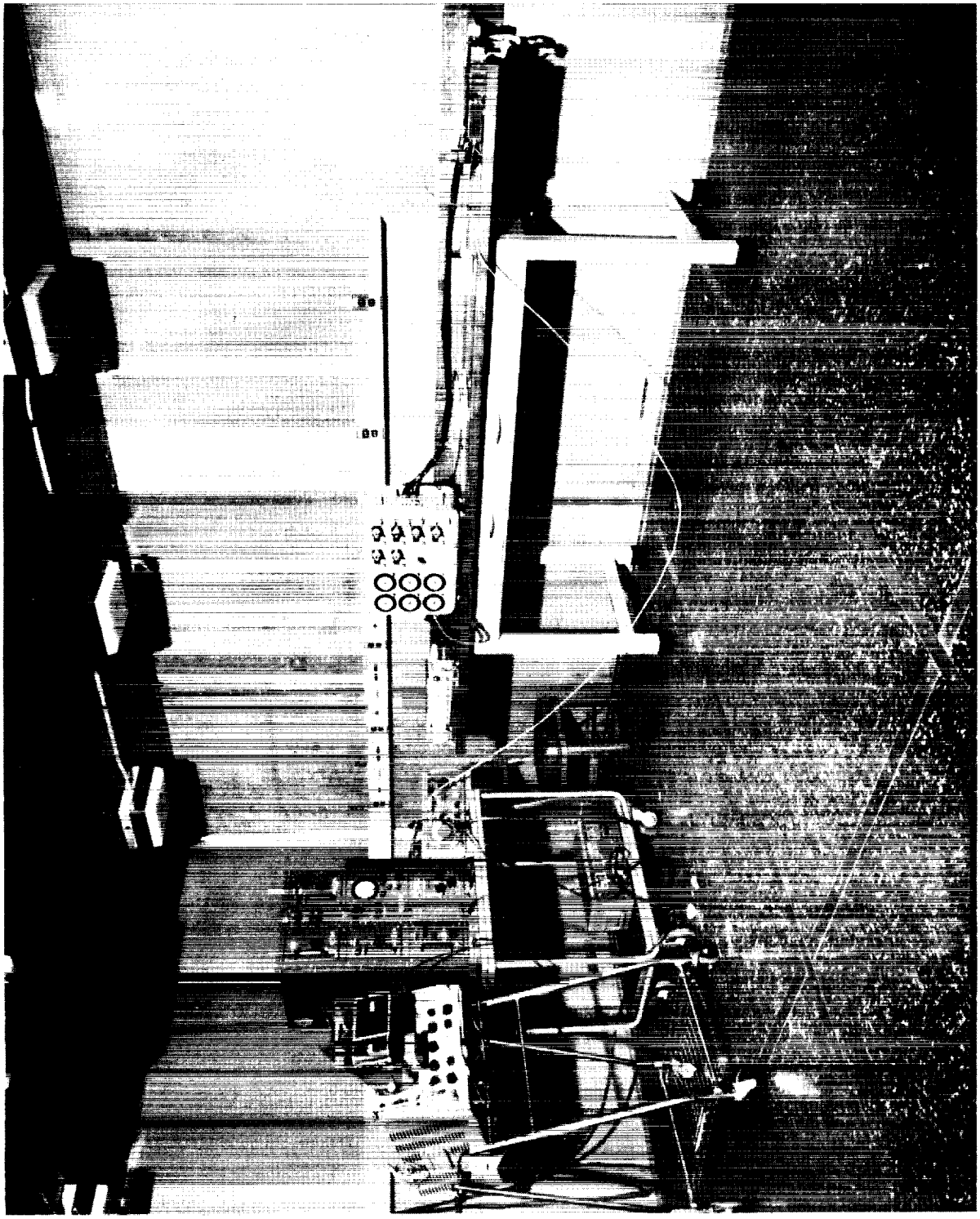


Figure 22. Conducted Interference Test Setup

RADIATED INTERFERENCE TEST SETUP

Figure 23. Radiated Interference Test Setup Using 41-Inch Rod Antenna

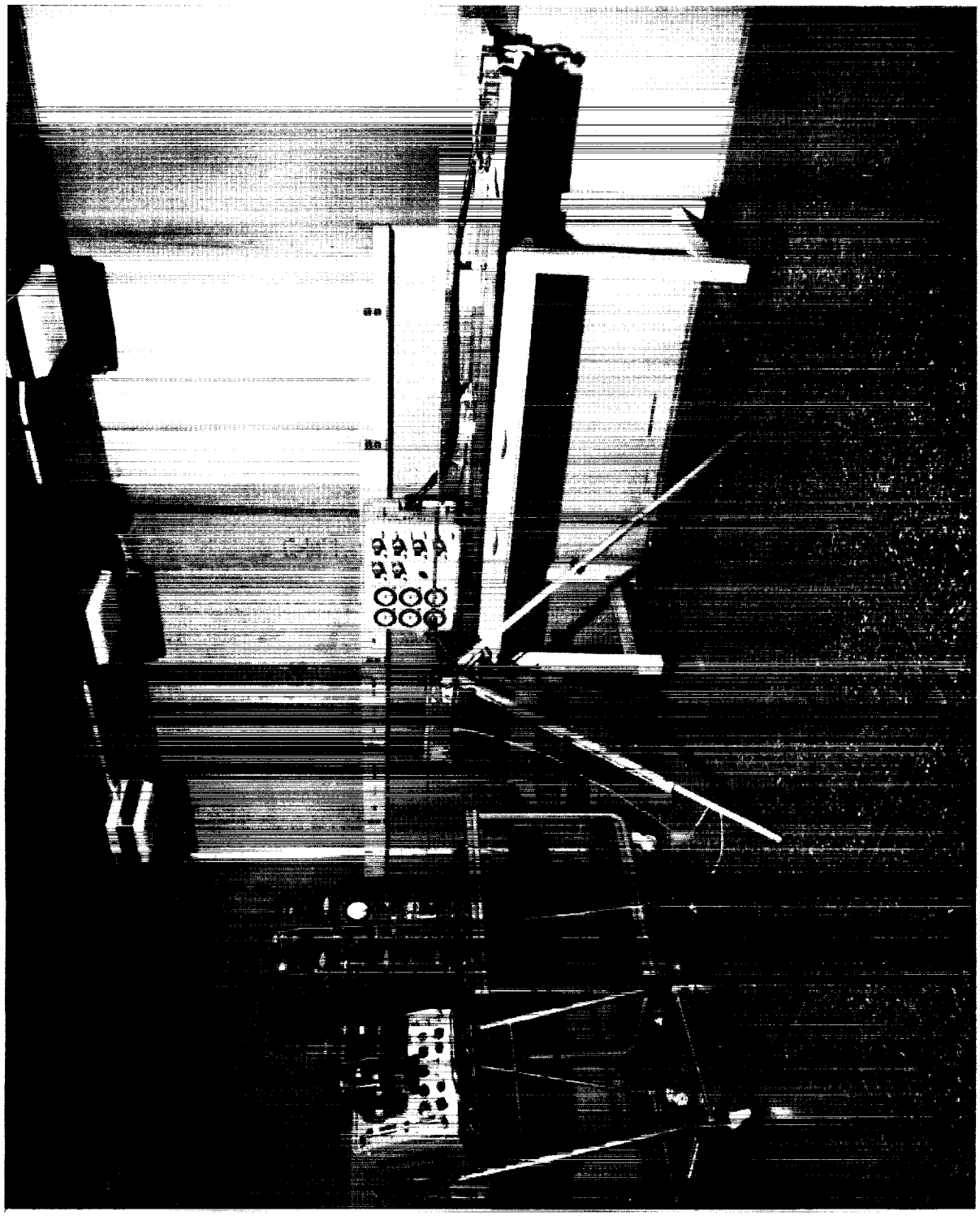


Figure 24. Radiated Interference Test Setup Using Tuned Dipole Antenna

RF RADIATED SUSCEPTIBILITY TEST SETUP

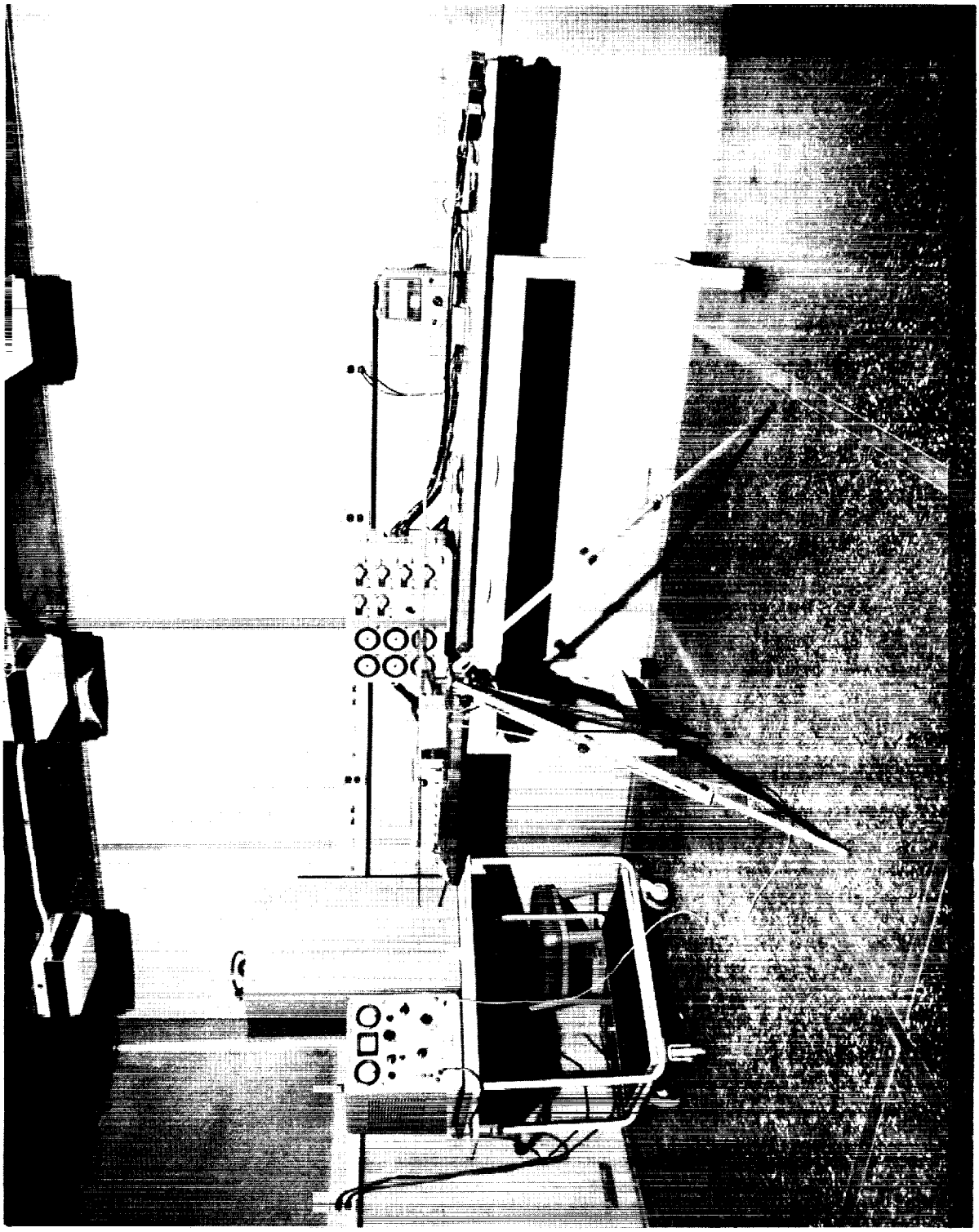


Figure 25. Radiated Susceptibility Test Setup Using Dipole Antenna